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AVIATION WEEK

September 19, 1949

NEWS DIGEST

DOMESTIC

AOA PAA merger agreement, due to expire last week, was extended until Mar. 13, 1950, with provision for further three-month extensions. A change in the pact specifies that PAA will pay $17,450,000 cash for AOA assets and assume latter's liabilities as of closing date. Original agreement provided for stock exchange rather than purchase by cash.

Eastern Air Lines has asked CAB permission to operate 4-cent per mile coach service from New York to Miami and New Orleans, starting Sept. 25. Carrier probably would use 56-passenger DC-4s.

Swedish Saab Scandia, 24-seat prototype transport, opened U. S. tour for checking sales possibilities at East Hartford, Conn. After stop at New York, it was slated for visits this month to Washington, Akron, Chicago (on Sept. 18, 19), Minneapolis (20), Kansas City (21 to 23), Denver (24 to 27), Dallas (28), Houston (29, 30 and Oct. 1). On Oct. 4, it is scheduled for Atlanta showing, Miami on 5, 6 and 7, then returning to New York or East Hartford for flight home or to South America. Craft is powered by P&W R-2000s, but production versions will have R-2180s. Goodyear Aircraft Corp. may be interested in producing Scandia here.

Northwest Airlines plans to start Stratocruiser service to Hawaii on Nov. 1.

United Air Lines' August passenger traffic was up six percent over same month in '48, and slightly above July, '49.

Lockheed Constellation became the world's first craft certified for international operation in compliance with International Civil Aviation Organization's airworthiness standards, which became effective Sept. 1.

Sikorsky Aircraft division of United Aircraft Corp. marked 10th anniversary of VS-300 copter's initial flight, this month. More than 600 of the company's helicopter successors to the craft have flown in military and commercial service, piling up in excess of 80,000 hr.

George W. Houk, founder and president of Dayton Aircraft Products, Dayton, Ohio, died at Portland, Ore.

New CAA Airport Advisory Committee elected A. B. Curry, Miami, chairman, and Walter E. Betsworth, Waterloo, Iowa, vice-chairman, at the opening of its three-day session in Washington. Next meeting will be in Los Angeles in January. Committee heard discussions on airport needs from representatives of airlines, private pilots, Post Office Department, and state aviation officials and Administrator Delos W. Rentzel.

FINANCIAL

National Airlines reports $38,963 profit for fiscal period ending June 30, against loss of $2,309,000 for fiscal '48. Fiscal '49 revenues were highest in NAL history, and profit was achieved after absorbing costs of DC-6 grounding, also strike of pilots and ground employes.

Northeast Airlines is committed to start retiring its $1,750,000 RFC loan, with $32,000 monthly payments, on Nov. 16. Under loan agreement, NEA may not declare dividends, consolidate, merge, or make purchase or construction commitments of over $100,000 without RFC approval.

All American Airways reports $255,766 net loss for fiscal year ending June 30, compared with $144,340 deficit for fiscal '48.

Parker Appliance Co. shows net loss of $156,827 on sales of $7,545,862, in annual report for year ending June 30, compared with net income of $100,558 on sales of $5,581,415 in '48. Loss reflects reduction in inventory of about $600,000 charged to year's operation and representing write-down to estimated realizable market value or removal from inventory of some slow-moving items and other high-cost units being discontinued. Total of $214,404 was spent on machinery and other capital improvements. $307,500 for new Los Angeles plant.

INTERNATIONAL

Czechoslovak Airlines will receive further consignment of eight Ilyushin 12s. Two of these craft are in regular service on Prague-Paris run.

Italian Flyers Capts. John Brondello and Camillo Bariogio, landed their Beech Bonanza at Lagens Airfield, Azores, when gas line trouble cut short their attempted east-west hop over the Atlantic from Lisbon.

Quebec Airways DC-3 crash on mountainside near St. Joachim, Que., killed all 23 aboard. Carrier is subsidiary of Canadian Pacific Air Lines.

Military Air Transport Service is ferrying 30 reconditioned C-47s to Greek Air Force. Planes were procured from non-military sources in U. S., will be paid for under Greek Aid program.

Polish Airlines LET has purchased 28 planes from Russia. They are reported to be "most modern Soviet planes, equipped with radar."

AVIATION CALENDAR

Sept. 18-20—International Northwest Aviation Council convention, Spokane, Wash.

Sept. 22-23—ARC CAA CAB transport meeting on CAR 4b policies and interpretations. Hotel Statler, Washington, D. C.

Sept. 26-28—National Electronics Conference, Edgewater Beach Hotel, Chicago.

Sept. 27-30—1949 fall meeting, American Society of Mechanical Engineers. Hotel Lawrence, Erie, Pa.

Oct. 3-8—Twentieth anniversary meeting, Ninety Nines. Waldorf-Astoria, New York.

Oct. 4—Committee on Aviation and Airport Fire Protection of National Fire Protection Assn. meeting, Wings Club, Hotel Biltmore, New York City, 10 a.m.

Oct. 5-8—SAE national aeronautic meeting and aircraft engineering display, Biltmore Hotel, Los Angeles.

Oct. 7-8—American Air Mail Society exhibition and convention. Edgewater Beach Hotel, Chicago.

Oct. 12-15—Air Reserve Assn. convention, Long Beach, Calif.

Oct. 13-15—1949 conference on airport management and operations, sponsored by University of Oklahoma and Southern Flight magazine, Norman, Okla.

Oct. 17—Fall meeting, New York State Aviation Council. Hotel Syracuse, Syracuse, N. Y.

Oct. 17-36th NASC steering committee meeting. Dayton, O.

Oct. 18-19—6th NAS council meeting. Wright-Patterson AFB, Dayton, O.

Oct. 30—Third annual San Francisco Air Fair, sponsored by Junior Chamber of Commerce. San Francisco Airport.

Oct. 30-Nov. 2—Annual convention, National Assn. of State Aviation Officials. New Orleans.

Nov. 9-11—Seventh annual meeting Aviation Distributors and Manufacturers Assn., French Lick Springs Hotel, French Lick, Ind.

Nov. 30-Dec. 2—Annual meeting Society for Experimental Stress Analysis. Hotel New Yorker, New York.

Jan. 13-15, 1950—All American Air Maneuvers, Miami.

Mar. 6-9, 1950—47th annual meeting American Road Builders' Assn. Netherlands Plaza Hotel, Cincinnati.

Mar. 28-31, 1950—National Plastics Exposition, sponsored by Society of the Plastics Industry, Navy Pier, Chicago.

PICTURE CREDITS

11—Topical Press. 12—Flight. 13—McGraw-Hill World News. 14—(top) Acme (center left and bottom) McGraw-Hill World News, (center right) Frederick R. Brewster. 15—(top and center) Flight (bottom) Topical Press. 16—Frederick R. Brewster. 35—(top) CEA (right) Acme. 37—PAA.

WHO'S WHERE

Changes

Warren R. Smith, who resigned as director of public relations at Fairchild Engine & Airplane Corp.'s aircraft division at Hagerstown, Md., during last summer's fight over company control, is back as company director of public relations. He also is assistant to President **Richard S. Boutelle**, who led the fight for the management change. In the public relations post he succeeds **Joseph Lowes**.

Dr. L. I. Shaw, rocket engineer for Bell Aircraft Corp., has resigned to become consultant engineer for Solar Aircraft Co., San Diego, Calif. Before joining Bell in April, 1948, he was director of the Air Force jet propulsion project at Alfred University.

Joseph K. McLaughlin, former attorney-advisor for CAA's third region, has succeeded **Robert Dewey**, resigned, as director of the Illinois Department of Aeronautics.

Ivor H. McClure, Assistant Secretary General for Air Navigation of the International Civil Aviation Organization, is returning. He formerly was with the U. K. Ministry of Civil Aviation.

Continental Casualty Co. has appointed **Charles L. Thompson** superintendent of the Metropolitan and Eastern departments of its Aviation Accident Insurance division. **Robert Bolson**, who was associated with Thompson, is being transferred to the company's Los Angeles branch. **Eugene Mulane** and **Robert White** will assist Thompson in his new post.

George Grimminger, author of the Rand report on analysis of the upper atmosphere (AVIATION WEEK, Aug. 22), has left the Rand Corp. to serve with the Weapons Systems Evaluation Group in the Department of Defense.

Awards and Honors

Harlan D. Fowler, inventor of Fowler flaps for airplanes, has been awarded a John Price Wetherill medal by the Franklin Institute for his work on the problem of variable lift airplane wings. **Harold J. Roig**, former president and now director of Panagra, and **Douglas Campbell**, its vice president and general manager, were honored by the Peruvian government for their part in developing air transportation between Peru and the U. S. The John Scott award will go to **Frank W. Caldwell**, director of research at United Aircraft Corp., for development of the controllable pitch propeller. **Dr. Albert Plesman**, president of KLM for 30 years, also celebrates his 30th year in civil aviation this fall. He is 60.

What They're Doing

Charles H. Hubbell of Cleveland, well-known aviation artist, plans a 30,000-mile tour of Military Air Transport Service routes and bases. He will paint MATS planes and pilots for the 1951 calendar of Thompson Products Inc. **Harold Gatty**, who flew around the world with Wiley Post in 1931, now operates a sports fishing business in Suva, Fiji, where Grant McConachie, Canadian Pacific Air Lines president, saw him last summer.

INDUSTRY OBSERVER

(This week's column is devoted to the observations of AVIATION WEEK editors who attended the 10th annual exhibition of the Society of British Aircraft Constructors at Farnborough airdrome in England.—Ed.)

► **LONDON**—Douglas Aircraft Corp. Super DC-3 program may get some stiff competition in foreign markets from a British plan to be announced shortly for equipping DC-3s with two 1400 hp. Mamba turboprop engines as replacements for the piston engines now used. Armstrong-Siddeley Motors has been flying a test DC-3 equipped with two Mambas for some time and will shortly begin a campaign among foreign DC-3 operators to sell the Mamba as a means of enabling the old reliable of the air transport business to meet the latest ICAO requirements and get a new lease on life. Price of a pair of Mambas is expected to be considerably less than the $150,000/$200,000 Douglas estimates for its conversion of old DC-3s into the Super model.

► Although John Derry, de Havilland test pilot, is officially credited as being the first British pilot to hit sonic speed when he dived the DH 108, sweptwing research plane for the Comet project, just past Mach 1 a year ago, informed British sources believe the honor really belongs to English Electric Co. test pilot R. P. Beaumont, who hit Mach 1 several months before Derry while flying a North American F-86A in California. Beaumont is the pilot who made SBAC show visitors take a second look at the Canberra twin jet light bomber with his incredible display of low level speed and maneuverability with the big plane now in production for the Royal Air Force.

► British Overseas Airways is replacing its grounded Canadair Fours on Asiatic routes with Douglas DC-4s chartered from Skyways, a British non-scheduled operator. The Canadair Four, dubbed the Argonaut by BOAC, has had cooling pump trouble in tropical climates.

► British Ministry of Supply, which directs all aeronautical research in England, is now using the NACA technique of aerodynamic research rockets for gathering data on supersonic flight. On display at Farnborough was a 20 ft. research rocket that has provided data up to 1200 mph and Mach 1.4 on test flights. Christened "Lizzie" by the British scientists, the rocket uses a solid fuel booster to get off the ground, then drops the booster and automatically cuts in a 2800 lb. thrust rocket motor fueled by alcohol and oxygen. It has a flight duration of 25 seconds.

► Magnetic aircraft fire detectors and a new type of automatic ground recorder of signals from aircraft in flight were among the other gadgets displayed by the Ministry of Supply that are of particular interest to American airline and traffic control experts. The magnetic fire detector operates on the principle that when iron magnets are heated rapidly they lose their power of attraction. Magnets holding open a fire alarm control switch will release the switch and sound an alarm when the temperature is raised by fire. American fire and smoke detectors are activated by photo-electric cells and carbon dioxide detectors.

► British are working along lines parallel to American research in reducing the weight of aircraft electronic gear. Some experimental units of aircraft radio equipment turned out by British researchers have reduced the unit weight by 85 per cent over conventional equipment.

► Vickers-Armstrongs' Supermarine Type 510, the sweptwing version of the Attacker powered by a late model Nene with better than 5000 lb. static thrust, indicated that it was considerably faster and more maneuverable than its competitor, the Hawker sweptwing P. 1052, also powered by the same model Nene. These two experimental fighters are both capable of supersonic flight. Vickers' test pilot Lithgow flew the Type 510 with its new needle nose and 45-degree sweepback (contrasted with Hawker P. 1052 35-degree sweepback) at 670 mph. in low-level pass from diving start, unofficially equalling F-86 world speed record.

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Newest British Aircraft Revealed at Show

Turbine-powered military and transport planes give spectacular flight displays.

By Robert Hotz

LONDON—The latest in British transports and military aircraft roared off the wavy black asphalt runways at Farnborough last week in a five day display to spearhead a British sales campaign aimed at exporting $132 million in planes and engines by 1950.

Opening of the 10th annual Society of British Aircraft Constructors exhibition was keynoted by appeals from British government leaders to push aircraft export sales to a new peak, renewed confidence of British aircraft builders in their commercial products, and a strong British press reaction assuring readers that 'British aircraft again lead the world." These sentiments were echoed by Sir Roy Dobson president of A V. Roe Ltd and SBAC president who said at Farnborough:

▶"Best In World"—' This show is ample evidence that our dependence on U S aircraft is a phase that is now passing. There are planes on view here that cannot be beaten anywhere else in the world and there are other planes coming forward but secrecy prevents them from being shown this year."

Some British manufacturers took a more sober view, but generally feel they have now emerged from their postwar slump in civil aviation development and are in a position to give American transport builders stiff competition in international markets. Veteran observers of the SBAC show agreed that the 1949 display far surpassed any other since the war particularly in the number and quality of civil transports in the flying stage.

▶**Foreign Delegations**—The SBAC attracted several thousand foreign military and civil aviation experts from 34 countries, representatives of 40 airlines, and roughly a quarter million Britons on the two public days. Among the American contingent viewing the show were Harold Harris, president, and Larry Fritz, operations director, of American Overseas Airlines, Rear Adm. Alfred M Pride, chief of the Navy Bureau of Aeronautics; Ivan Driggs, director of the Navy's aircraft design research division; Maj Gen Carl Brandt, chief of U S Air Force requirements division, Maj. Gen. Donald Putt, USAF director of research and development, Maj Gen Leon Johnson, commander of the Third Air Division; George B Woods, special assistant to USAF Undersecretary Arthur Barrows, and a large group of U S military and civil air attaches and Western Union defense staff members.

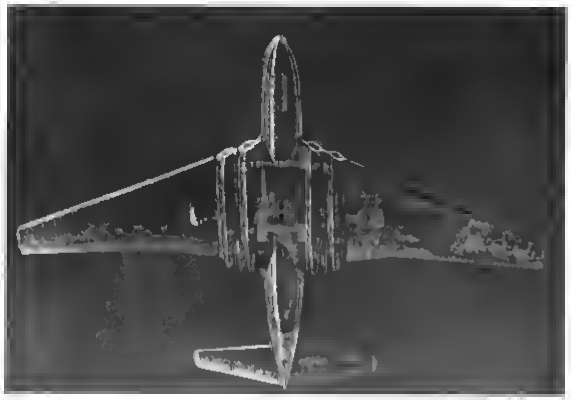
For most American observers the twin attractions were the gas turbine-powered commercial airlines and the mighty Rolls-Royce Avon turbojet engine now officially rated at 7500 lb static thrust. Unveiling of the axial flow Avon, which is now flying in the Canberra twin-jet bomber and a Gloster Meteor fighter indicates that the British are still maintaining a margin over U S engine manufacturers in this vital field. Most powerful U S jet engine in a comparable state of operational use is the General Electric J-47 rated at 5200 lb, but now actually delivering 5600 lb static thrust.

▶**Comet Shines**—Brightest star in the British transport galaxy, is of course, the de Havilland 36 passenger Comet powered by four DH Ghost (5000 lb thrust) turbojets. Considerably smaller than the Douglas DC-6 and the Handley Page Hermes series, the Comet is one of those planes that cannot be fully appreciated until it is seen flying.

Although it was flying nearly empty at Farnborough (except for fuel and test instruments) its flight performance in the hands of DH chief test pilot John Cunningham gave observers a good approximation of its flight characteristics.

De Havilland is still extremely secretive on details of the Comet's construction and performance, but the first 35 hours of test flying have seen the jet airliner surpass its designed cruising speed of 500 mph and its anticipated cruising altitude of 40 000 ft. Comet has reached Mach 8. Observers were impressed with its short takeoff run (considerably less than that of an F 80) and the moderate approach and landing speeds.

It is obvious from the long, thin wing combining 30 deg of sweepback with high taper that the Comet has a wing loading probably not as high as some American transports now in service. Approach and landing are aided by a tremendous flap area extending inboard from the ailerons to the fuselage. The flaps include a special arrangement whereby the under side of the jet engine nacelles are split laterally and the bottom half lowers to become part of the flap area.



COMET Shining star in Britain's transport galaxy must be seen to be appreciated

Cunningham, who has done all of the Comet flying to date, greased the Comet onto the undulating main runway at Farnborough in a series of nearly perfect landings that gave a deceptively light impression of the landing impact In the air Cunningham demonstrated rate of climb, maneuverability and speed with a low level buzz across the field at 500 mph

▶ **Graceful Appearance**—Combination of high aspect ratio and sweepback give the Comet an unusually graceful appearance in the air seldom found in workhorse transports The pointed, downswept nose gives it an atmosphere of speed like that achieved by a similar configuration in the Lockheed Constellation

The Comet is not a particularly radical-looking plane De Havilland officials indicated that they modified original design plans to retain more conventional features calculated to reassure prospective passengers Of special interest is the manner in which the 53-in diameter Ghost turbojets have been buried in a thin wing There is little nacelle protuberance In a head on flight view it is hard to spot the Comet's engines

Drag profile is extremely clean De Havilland is already well along on production of the initial order for 16 Comets—two for the Ministry of Supply and 14 for British Overseas Airways Corp

Tentative plans of BOAC indicate the Comets will get their initial airline proving on the Empire routes to Africa and Australia rather than on the blue ribbon North Atlantic run

▶ **Turboprop Planes**—Next to the Comet foreign interest centered on the largest collection of turboprop powered airliners ever displayed These include

• **Miles Marathon**—20 passenger 254 mph feederliner powered by two 1400 hp Armstrong-Siddeley Mamba turbo props

• **Vickers Viscount**—32 passenger 276-mph liner powered by four Rolls-Royce 1300-hp Dart turboprops

• **Armstrong-Whitworth Apollo**—31-passenger 305-mph liner powered by four 1400 hp Mamba turboprops

• **Handley Page Hermes V**—60 passenger, 346-mph liner powered by four 2800-hp Bristol Theseus turboprops

The 85,000-lb Hermes V is the largest turboprop airliner now flying It made its first flight only a few weeks ago and its first public appearance at Farnborough Comparison of the Hermes V with its piston-powered counterpart the Hermes IV should provide interesting data on the relative operational merits of the two types of powerplants for airline use The Hermes V has a thinner and lighter wing than the Hermes IV which uses the heavier military type wing developed for the Handley Page Hastings

The turboprop Hermes IV grosses 2000 lb more than the V and carries nearly 2500 lb more payload It cruises at 62 mph faster than the piston powered Hermes, climbs nearly 1000 fpm faster and has a service ceiling 5000 ft higher The Hermes series is slightly smaller than the DC 6

▶ **Apollo vs. Viscount**—Principal competitors for the immediate foreign airline market are the Viscount and Apollo Vickers is going into production on a 40 passenger larger version (Model 700) of the Viscount with an order for 32 transports—20 for British Eurooean Airways and 12 for BOAC Initial Viscount service is expected to be on BFA's Continental services and on BOAC's West Indian routes Vickers also has plans for a 53 passenger version of the Viscount 700 Cruising speed on the production Viscount will be boosted from 276 mph for the prototype to 328 mph with a payload boost of nearly 5000 lb Gross will be increased from 40,400 lb on the prototype to 43,000 lb on the Model 700

The Viscount would be competing in the Convair Liner class for the foreign market and is expected to sell for about $350,000 in contrast to the present Convair-Liner price of about $500,000 Australian National Airlines is extremely interested in the Viscount and is expected to close a deal with Vickers for 10 Viscount Model 700s shortly

The Apollo impressed foreign observers as perhaps a more advanced airframe design than the Viscount but development delays of the Mamba engine retarded its entry into flight testing for nearly a year The Apollo has a heavy vertical and dorsal fin which should produce good directional stability British pilots who have flown the Apollo confirm this characteristic, particularly when flying with two engines feathered on the same side

Like the Viscount the Apollo impresses passengers with its vibrationless flight and low noise level Belgian SABENA and the Argentine FAMA airlines have been particularly interested in buying the Apollo and preliminary negotiations are under way for initial sales

With a gross of 43,000 lb the Apollo offers payloads of 7500 lb. and cruises at 305 mph over a range of 1000 miles This compares with an 1800-mi range for the Viscount 700

▶ **Marathon**—The Marathon offers another interesting contrast between a piston and turboprop powered version of the same airframe Substituting two Mamba turboprops for four Gipsy Queen piston engines increased total horsepower by 600 reduced gross weight by 2200 lb and increased cruising speed by 43 mph There are as yet no firm orders for the Mamba-powered Marathon either from British or foreign airlines

As the turboprop liners awaited takeoff they sounded more like railroad steam engines than aircraft All of the large turboprop airliners flying demonstrated cruising and climb characteristics with two of their four propellers feathered on the same side The Marathon flew and landed on a single engine

Britain's largest transport, the Bristol Brabazon I—in later versions also slated to use turboprops—flew over the show once at 180 mph and 300 ft. altitude, piloted by A J. Pegg

▶ **Canberra Shows Off**—Biggest military surprise of the show was the English Electric Co sky-blue Canberra jet bomber U. S observers were not impressed with the Canberra's straight wing and somewhat conventional configuration on the ground But in the air, the combination of test pilot R P. Beaumont and the 15,000-lb. thrust from the two axial Avons made the Canberra behave in spectacular fashion

Its speed range from 500 to less than 100 mph was ably demonstrated by Beaumont who followed his high speed passes on the deck with an approach using full flaps and gear down and bomb bay doors open that slowed the Canberra to less than 100 mph At this speed he rocked the big bomber violently with ailerons to show the full control available as it approached stalling speed.

Beaumont whipped the bomber (designed to carry a 10,000 lb bomb load) around on the deck like a fighter, flying it through a series of slow rolls, high speed turns and remarkable rates of climb The Canberra was originally designed for radar bombing at around 50,000 ft but Beaumont's demonstration convinced many Britishers the new bomber may prove to be another Mosquito in its versatility at everything from low level attack through night fighting and high altitude bombing

▶ **Light Bomber**—According to USAF standards the Canberra is classified as a light bomber, a field in which there have been no outstanding American postwar planes U. S. Ground Army high command has been subjecting USAF to heavy pressure to develop a low-level jet attack plane that would combine many of the qualities displayed by the Canberra

The Canberra has a span of 64 ft., length of 65 ft., 6 in Tail stands 15 ft., 7 in. above the ground Wing has an aspect ratio of 4 3 Fuselage is slung so close to the ground that there is barely clearance for the tandem nose wheel Mechanics have easy access to the Avon engine nacelles without the use of ladders or work stands In addition to the pilot the Canberra carries a radar operator

English Electric is building 12 for Royal Air Force service testing.

▶ **Delta Wing**—Most radical British design on display was the Avro Model 707, a Delta wing research plane The Avro Delta is roughly comparable in general appearance to the Northrop X-4 and Convair XF-92A Its Delta wing is located midway up on the fuselage and has a thick root tapering to a thin tip The Avro Delta has a long dorsal fin but small rudder and vertical fin Air intakes for the 3500 lb thrust Derwent 3 turbojet are located on top of the fuselage behind the cockpit The intake is bisected by the dorsal fin

Outboard sections of the wing trailing edge are used for elevon controls with the inboard sections lowering on three supports as flaps Wing span is 33 ft and fuselage is 30 ft., 6 in long The Avro Delta had had only two hours flying time when it appeared at Farnborough It is being used as a research plane for an Avro four jet Delta wing bomber project The Avro jet bomber is scheduled to be considerably bigger than the Canberra and will fall into the USAF classification of a medium bomber

Among the other outstanding military aircraft on display were

• **De Havilland Venom (DH-112)**—The latest version of the Vampire featuring a 66 percent increase in power and aerodynamic modifications for flight at high Mach numbers The power plant is a DH Ghost turbojet (5000 lb thrust) A thin high-speed airfoil has been substituted for the normal Vampire wing Jettisonable wing tip tanks have been added for the first time in the Vampire series to increase range The Venom is in the 650 mph plus class and maintains its operational efficiency into the 45,000-50,000 ft altitude range.

• **De Havilland Night Fighter (DH-113)**—This is the first British jet night fighter and is based on a standard Vampire design Modifications include a longer cockpit to accommodate a radar operator, an elongated upturned nose to house airborne radar gear; nose wheel strut moved back slightly to give the radar nose more ground clearance, and additional fuel capacity The night fighter, which was ordered into production this spring, is powered by the 3500 lb thrust DH Goblin engine

• **Westland Wyvern**—This is the first fighter powered solely by a turboprop It mounts an Armstrong-Siddeley 4100-hp Python turboprop in the nose, turning contra-rotating four-bladed propellers and producing jet thrust through tail pipes just above the wing on both sides of the cockpit The Python is the most powerful turboprop now flying in an operational aircraft and has just passed its 150 hour type certification for both civil and military use The camel-back Wyvern is being built for carrier service with the Royal Navy and is scheduled to begin carrier trials in October Present plans calls for equipping one carrier air group with the Wyvern

• **Gloster Meteor Mark VIII**—This is the latest version of the Meteor series and features a re-designed tail aimed at better stability at high Mach numbers; an elongated nose adding a fuselage fuel tank, and three jettisonable fuel tanks two on the wing tips and the third fitted under the fuselage similar to the tank on the McDonnell Phantom

(Continued on p. 16)

VISCOUNT prototype performance was pleasing, but larger production version, Model 700, will be even better

Society of British Aircraft Constructors Shows . . .

Avro 707

Avro 707

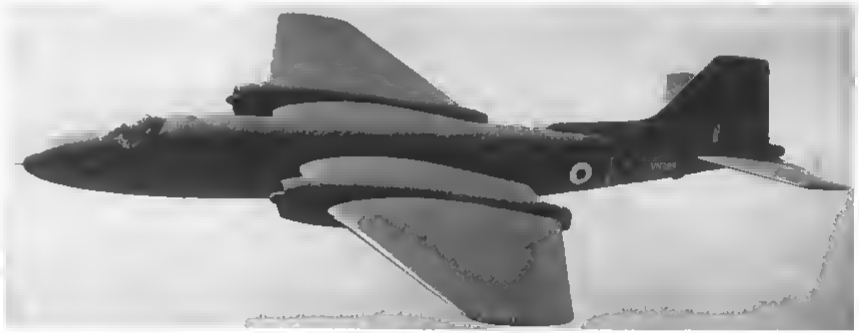
Avro 707

DH 113

DH 112 Venom

. . . Its Bids for World Air Leadership

Apollo



Canberra

Brabazon 1

WYVERN First turboprop fighter has most powerful turboprop engine

Farnborough Show

(Continued from p 13)

▶**Fighter Trends**—The British fighter trend continues basically toward designs through aerodynamic refinements and increased power to produce high speeds and high altitude performance required of modern jet fighters. As yet undiscussed publicly, but definitely in the wind, is a British switch to the rocket-powered interceptor type fighter.

Decision to concentrate basic RAF production on the two standard types rather than switching to the Vickers swept wing Type 510 or the Hawker swept-wing P 1052 is largely a matter of cost—it being considerably cheaper to modify the Vampire and Meteor rather than tool up for large production of basic new types.

British fighter experts believe the Vampire and Meteor designs still have considerable scope for development and may soon go to swept wing versions. Another basic trend, similar to that pushed by USAF, is the cramming of more fuel into jet fighters to increase range and endurance.

A Vampire and a Meteor were demonstrated equipped with afterburners (which the British call a re-heat) and another Meteor performed fitted with two Avons. The 15,000 lb. thrust behind the tiny fighter was evident in the performance of acrobatics, climb and high speed passes on the deck.

▶**Helicopters**—In addition to its triple rotor Air Horse helicopter, Cierva displayed a new version of its two-seater Skeeter helicopter that gave a modernistic design touch to the basic Skeeter Mark I machine. The new Skeeter is priced at around $14,000 and can be used either as a personal helicopter or a trainer. Cockpit is fitted with dual controls, the cabin is plexiglass from seat level up, affording excellent visibility in all directions and an amber glare proof transparent plastic is used for the cabin roof.

Powered by a Gipsy Major Ten engine, the Skeeter Mark II has a maximum sea level speed of 95 mph. and an 88-mph. cruising speed over a range of 186 miles. Absolute ceiling is 14,250 ft. Main rotor blades are plywood with an all-metal tail rotor.

There were no new lightplanes demonstrated at the show.

Navy Inquiry

Little new turned up in probe of anti-B-36 campaign.

Navy court investigating sources of the B-36 "anonymous letter" wants to hear more about Navy Capt. John G. Crommelin's statement that the "navy is being nibbled to death in the Pentagon."

The veteran Navy pilot and carrier commander will be called to testify when the court reconvenes Sept. 21 after a week's recess. Meanwhile, supporting statements issued by such Navy top brass as Fleet Adm. William 'Bull' Halsey (Ret.) and Rear Adm. Austin K. Doyle, head of Navy Air Training, praised Crommelin's "wonderful courage." Said Halsey: "He deserves the help and respect of all Naval officers."

▶**Charged Domination**—Crommelin charged that the Army General Staff dominated the armed services causing Navy fighting efficiency to suffer, and attacked the Tydings Law passed this year to tighten unification as aiding a trend toward dictatorship in the armed services.

His statement originally was prepared for an expected appearance at the Navy court, but when the court recessed without hearing him, he released the statement to the press. "The Navy's fighting spirit is going to pot and I just can't stand it any longer," he told reporters. He expressed hope that his statement would bring on another congressional investigation, even at the risk of his career.

Rep. L. C. Sasscer (D., Md.), a top ranking member of the House Armed Services Committee has called for congressional inquiry on the roles of Army, Navy and Air Force in defense and security, adding that differences between the services should be watched carefully so that "enthusiasm of one branch of the services doesn't subjugate, scuttle and destroy the spirit and morale of the other branches."

▶**Martin Testimony**—Glenn L. Martin, chairman of the company bearing his name testified earlier before the committee giving an account of his conversations with Cedric Worth, then assistant to John Nicholas Brown, Assistant Secretary of the Navy for air. Worth admitted writing the "anonymous document" in testimony before the House Armed Services Committee (AVIATION WEEK, Aug. 29 and Sept. 5).

Martin testified that Harold Mosier, his Washington representative, made an appointment for Worth to see him in his Baltimore office on Apr. 13. Worth, Cmdr. Tom Davies, and Mosier attended the conference.

"Mr. Worth said in substance, that he was greatly concerned with certain current developments in the aircraft field which had been and were then being reported or rumored in magazines and newspapers and elsewhere. His stated interest in seeing me was to find out whether I had any factual information bearing upon any of these reports or rumors," Martin said.

▶**Turret Contracts**—"Only subject which was brought up on which I supplied any such information was the matter of the threatened termination of our turret contracts during the war and the transfer of that business to the Emerson Electric Co. He had heard—not from me—that there had been such an incident and asked me about it.

"I confirmed the fact that at one time such a termination and transfer had been seriously considered but had not been put through. That is the only bit of information, appearing in the document introduced Aug. 24, 1949, before the House Committee on Armed Services, which I could, in a sense, be said to have supplied. That bit of information, small as it was, was correct."

▶**Statler Meeting**—Martin said Worth advised him he was compiling material on the reports and rumors, and later telephoned from Washington to offer a copy of his compilation. Martin was coming to Washington the following

afternoon (Apr. 20) on other matters and met Worth at the Statler Hotel. "At that time he gave me a copy of the document and that is all. There was no further discussion between us."

Other witnesses included:

• **Cmdr. Tom Davies,** holder of the world nonstop distance record with the Lockheed P2V "Truculent Turtle" who sat in on the conference with Martin and Worth.

• **Hugh L. Hanson,** Navy aeronautical engineer who testified that the late Defense Secretary James Forrestal had told him that President Truman had wanted to let Air Secretary Symington "go" but that Forrestal had talked him out of it. (President Truman later in the same day described this testimony as a story out of whole cloth.)

• **Capt. Leroy C. Simpler,** Navy public relations, who testified he had been asked by Rep. Deane (D., N. C.) to provide some information for guidance of Jonathan Daniels, Raleigh, N. C., publisher as to whether he should accept an offer to become Secretary of the Navy.

• **Harold G. Mosier,** Martin's Washington representative, who described a preliminary luncheon meeting with Cmdr. Davies, and the meeting with Worth, Davies and Martin. Mosier said he later took a sealed envelope given him by Martin's secretary, which he believed to contain the Worth material to Senator Tydings' office.

Capital Buys 3 Super DC-3s

Purchase of three new Douglas Super DC-3s at approximately $250,000 each by Capital Airlines was announced as a first step in a "pay-as-you-go" new equipment program for the airline.

Announcement was made by Capital president J. H. Carmichael after a demonstration of the prototype Super DC-3 at Washington National Airport, attended by Donald W. Douglas, Sr., president of Douglas Aircraft Co. and other company officials.

► **First Airline**—Capital is the first airline to buy the DC-3 conversion although Douglas reports strong interest in the equipment by other lines, also. Capital now operates 24 DC-3s and the order for three DC-3s may be enlarged to supply additional replacements. The Capital new-equipment program also calls for new four-engine replacements for the DC-4s.

The Capital Super DC-3 will be a 31 passenger version, will have a cruising speed of 253 mph. (higher than the 4-engine DC-4) and a 270 mph top speed. Delivery of the three planes is scheduled for early spring and new aircraft will be placed in service then.

► **Wright-Powered** — Prototype Super DC-3 shown at Washington was powered with Wright 1820 C9HE engines while a second prototype with Pratt & Whitney R-2000-D7 engines is now being completed in Santa Monica and is due to fly in about a month. Plane now flying is on a 10,000 mi. demonstration tour, through Mexico, U. S. and Canada.

Two other major airlines, TWA and Eastern, are seen as other likely prospective buyers of Super DC-3s to replace their current DC-3 equipment, since both operate a number of short-haul routes.

Chicago and Southern is expected to announce shortly the purchase of a fleet of four-engine Lockheed Constellations as replacements for its 6 DC-4s.

New Rules Offered For Spray Craft

The Civil Aeronautics Administration has recognized the need for more liberal requirements to keep pace with the rapidly growing role of restricted purpose aircraft in agriculture and industry.

To foster development of this form of aviation, it has proposed a new Part 8 to the Civil Air Regulations for certification in the restricted-purpose category, together with a policy governing agricultural craft as a start.

Aim of these proposals is to:

• **Simplify the procedure** for certificating aircraft modified for these special purposes.

• **Provide simplified airworthiness standards** and methods of showing compliance therewith for new aircraft designed for these purposes.

• **Make the operator responsible** for adjusting the aircraft operating weight to existing flight conditions, instead of establishing rigid maximum weights by engineering tests corrected to standard conditions.

• **Initiate an educational program** to improve the safety of agricultural and industrial aircraft.

► **Compliance**—Type certificate would be issued if the aircraft is of a basic type complying with:

• **The airworthiness requirements** of the CAR.

• **Requirements** of a U. S. military service.

• **Requirements prescribed** for the special purpose involved.

The latter requirements would be based on CAR Part 3. Normal Category, modified to eliminate non-essential provisions for non-passenger carrying craft, simplify design provisions formerly called for; reduce amount of quantitative testing and, where feasible, permit demonstration of compliance by practical methods. Also included would be recommendations for safety provisions—good vision stall characteristics, and pilot crash-protection.

Under the proposed CAA policy, the craft, prior to certification, would be inspected by a CAA representative for general airworthiness and obvious unsafe features.

USAF Shuffle

Reshuffling of USAF general officers is moving two top Air Materiel Command generals into higher USAF staff posts in Washington, and resulting in numerous other changes both in the command and at Washington.

• **Maj. Gen. Kenneth Bonner Wolfe,** AMC Director of Procurement and Industrial Planning, and

• **Maj. Gen. Franklin Otis Carroll,** AMC Director of Research and Development, are coming to Washington.

Gen. Wolfe has already been nominated by President Truman for advancement to lieutenant general and for appointment as Deputy Chief of USAF Staff for Materiel, succeeding Lt. Gen. Howard A. "Pinkie" Craig.

Gen. Carroll is slated to fill the post of Assistant Deputy Chief of Staff for Materiel under Gen. Wolfe, although his appointment has not yet been officially announced. Carroll's new post will be that held until recent retirement by Maj. Gen. E. M. "Pop" Powers.

Wolfe's appointment is viewed as a strengthening of the Washington deputy post and as another indication of a trend toward centralizing more and more of procurement policy in Washington. Wolfe has been a major figure in USAF overall procurement policy while at AMC and is expected to take a far more important role in the headquarters staff than that played by Craig, in the same post.

Scheduled to succeed Wolfe as Director of Procurement and Industrial Planning at AMC is Maj. Gen. Orval Ray Cook, who has been Deputy to the Commanding General of AMC for Operations and as such has been closely associated with the procurement and industrial planning setup. Gen. Cook had succeeded Gen. Wolfe once before, as Chief of Production at AMC during World War II.

Brig. Gen. Horace A. Shepard, Chief of Procurement Division, is to continue in that post under the new director.

Brig. Gen. Samuel R. Brentnall, Deputy Director of Research and Development is expected to succeed Gen. Carroll at AMC. Brig. Gen. R. P. Swofford, Jr., has been advanced from Deputy Chief of the Engineering Division at AMC to acting chief following transfer of the former chief, Maj. A. R. Crawford.

Gust Loads Challenge Aircraft Designers

Present-day trends in airplane performance, weight, loading, size, bring major problem in gust resistance.

By Robert McLarren

Most of the trends over the past ten years have aggravated the problems of aircraft design. These trends have all stemmed from improved aircraft performance principally facilitated by improved powerplants. The tremendous powers, both from turbojet and piston engines, have permitted substantial increases in speed, altitude, gross weight, wing loading and airplane size, all tending to transfer greater energy to and absorb greater energy from the atmosphere.

The flight of today's airplane represents a much greater exchange of energy than did the flight of the average prewar plane.

▶ **Gust Load Troubles**—Each of these separate design trends has had an important effect on the relative susceptibility of the airplane to gust loads. Increase in cruising speed, for example, means that the airplane covers more miles per hour than did its predecessor and that its structure is exposed to more loads per hour.

An important trend has been a steady increase in useful load to gross weight ratio. Although this indicates improved structural design efficiency on the basis of strength/weight ratio, it also indicates a gradual increase in working stress, both at a load factor of one (cruise) and at ultimate design load factor. Tendency towards increased gross weight has resulted in a steady decrease in design load factor which, in turn, implies an increase in working stress.[1]

All of these trends, in the aggregate, mean that the modern airplane is operating at greatly increased frequency and severity of loading simultaneously with higher working stresses and lower load factors. Both of these conditions add up to growing gust loading troubles and these are becoming increasingly evident in accident reports.

▶ **Arbitrary Load Factor**—An obvious solution is simply to increase the design load factors of the airplane to a point well beyond any loadings encountered in flight. This approach actually has been taken in the case of the Bell X-1 and other research planes in the design of which an overall ultimate load factor of 18 was arbitrarily selected in the hope that this would exceed any flight loads encountered.[2]

To date this figure has proved adequate and there have been no instances of structural failure in research craft, even at supersonic speed.

However, this approach is both uneconomical and unfeasible. It is uneconomical because the airplane's performance would be penalized severely through the added weight, wholly unnecessary more than 90 percent of the time.

It is unfeasible because, despite extensive work that has and is being accomplished, comprehensive data on maximum loads experienced in flight are not yet available.

The only sound approach is to determine the severity and frequency of occurence of gust loads in structures, fatigue properties of aircraft materials, effects of stress-concentration factors and effects of the general airplane design and performance characteristics.

This manifold approach can produce an airplane design of a limited, but known, life expectancy. And this is the most economical airplane to build and operate.

▶ **Gust Cause**—Gusts are manifestations of turbulance created by fluctuations in the horizontal or vertical velocity of air currents. They occur under all atmospheric conditions. Clear or cloudy days, when the wind is strong or light, at night or during the day.

Gusts caused by fluctuations in the horizontal movement of air temporarily alter the craft's speed with respect to the atmosphere, resulting in sudden upward or downward motions of the airplane.

Consider, for example, a plane flying with a tailwind. If this tailwind suddenly increases, speed of the plane relative to the air is lessened and the plane drops. Conversely, if the tailwind suddenly decreases, speed of the plane with respect to the atmosphere is increased and the plane suddenly rises.

In the case of an airplane flying into a headwind, a diminution of wind velocity produces a slowing of the aircraft with respect to the air, and it drops as a consequence. An increase in the headwind produces a temporary increase in plane speed and the craft rides upward in a "bump," all too familiar to those who fly.

▶ **Bumps**—This same relationship obtains when the airplane climbs or descends through varying layers of air having different velocities. There is a marked stratification of the atmosphere and when passing from a strata producing a steady tailwind to one producing a lighter tailwind, the speed of the airplane is increased and a "bump" results; if moving into a strata with a stronger tailwind, the speed of the airplane is decreased and a "pocket" results.

This effect is reversed if the airplane is flying into a headwind.

Generally, this gustiness produced by purely horizontal variations in wind velocity produces only a minor change in airplane lift and, therefore, only minor structural loads.

▶ **Major Problem**—It is the vertical air movements that comprise the major gust problem since these reach velocities as high as 100 mph. in thunderstorms of great violence.

These vertical air movements, both up and down, are caused by variations in the density of adjacent masses of air resulting from changing temperature conditions.

Generally, a south wind is warmer, hence less dense than a north wind and, when the two meet, the colder air forces the warmer air upward, resulting in a density gradient existing between the two.[3]

If this density difference is pronounced, as in squall lines, the vertical velocities within the front can be violent and exceedingly irregular.

Naturally, for any mass of air that rises, an equal mass must come down, therefore, there are both vertically ascending and descending air currents producing both positive and negative gusts.

However, downward moving masses usually travel more slowly and are dissipated over a much greater area. Accordingly, these are less serious.

▶ **Gust Effects**—As previously mentioned, gusts due to variations in horizontal velocity of the air cause changes in the speed of the airplane and therefore effect only the total lift of the wing but not the lift coefficient.

Vertical gusts directly effect the wing lift coefficient and this, coupled with their greater velocity, create loads suf

ficiently great to result in structural failure of the wing and consequent destruction of the plane

Consider an airplane in steady level flight whose wing has the characteristics shown in Fig. 1(a). Now, assume that the plane, flying at velocity V, encounters a sharp edged gust with a vertical velocity KU, as shown in Fig. 1(b). These horizontal and vertical velocity components produce an angle-of-attack increment of $\Delta\alpha$. If this angle-of-attack increment is added to the existing angle of attack, as shown in Fig. 1(a), the result is a lift coefficient increment of ΔC_l.

Since the angle in radians is approximately equal to the tangent of the angle for small angles, then $\Delta\alpha = KU/V$ and $\Delta C_l = m\Delta\alpha = KUm/V$ in which m is the slope of the lift curve C_l per radian[4]. The load factor placed on the airplane is an addition to its cruise load factor and is, therefore, a load factor increment Δn.

From the foregoing this may be expressed[5]

$$\Delta n = \frac{\Delta C_l}{C_l} = \frac{KUm}{V} \cdot \frac{\rho V^2 S}{2W} = \frac{KUm\rho VS}{2W}$$

in which K is gust alleviation factor (to be discussed later), U, gust velocity, fps; m, slope of lift curve, C_l per radian; ρ, density, slugs per cu. ft.; V, velocity of the airplane, equivalent airspeed, mph., S, wing area, sq. ft., and W, airplane gross weight, lb.

►Light Planes and Heavy—It is apparent that a time interval must elapse between the instant of application of the vertical gust velocity and the physical change in angle of attack on the airplane wing, and for this reason the factor K is used to indicate the relative alleviation of the gust effect by variations in individual airplane characteristics.

For example, a lightly loaded airplane of the personal type would be quickly affected by the gust and ride upward fast enough to dissipate most of the gust force before its effect in an increment in wing loading could result.

A heavily loaded plane, on the other hand, would absorb most or all of the gust in an increment in wing loading with little or no dissipation of its effect.

Fig. 2 illustrates this variation with alleviation factor with airplane wing loading, and shows that the factor is quite low for low wing loadings but exceeds unity for wing loadings above 16 lb./sq. ft.

Effect of wing loadings higher than about 50 lb./sq. ft. on the alleviation factor is largely inconsequential.

►NACA Studies—One of the first design questions involved in a study of gust load criteria is the magnitude of the gusts the airplane may be expected

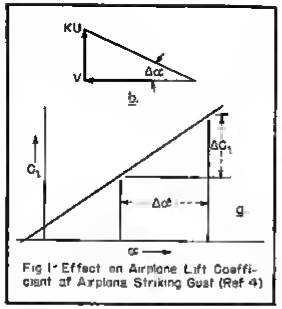


Fig. 1: Effect on Airplane Lift Coefficient of Airplane Striking Gust (Ref. 4)

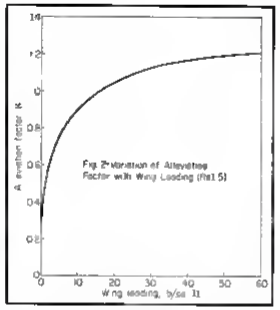


Fig. 2: Variation of Alleviation Factor with Wing Loading (Ref. 5)

to encounter. The airplane cannot sensibly be designed to withstand the maximum gust velocity of record, nor even the maximum estimated to be expected in service.

In establishing a gust load criterion, it is necessary to determine the highest gust velocity normally encountered in the service for which the airplane is intended, in the case of transport aircraft, regular airline operation.

To determine these intensities the National Advisory Committee for Aeronautics undertook a statistical study of airline operations in 1932 by the installation of V-G recorder equipment in transport craft then in operation. These included American Airways trimotor Fokker F-10As operating between Cleveland and Dallas, and Pan-American Grace trimotor Ford 5-AT-Cs operating between Buenos Aires and Santiago. Recorders continued to be installed through ensuing years on the Boeing 247 twin-engine airliner of United, Douglas DC-2 of TWA and Eastern, and Douglas DC-3 of a variety of airlines.

Subsequently, recorders were installed in the Boeing 307 Stratoliner, Boeing 314 flying boat, Martin 130 flying boat, Sikorsky S-42 flying boat, Lockheed XC-35 high-altitude research plane, and the Boeing XB-15 bomber.

►World-Wide Recording—V-G Recorder installations have continued in all the modern transports, both here and abroad, so that a continuous and comprehensive record is being obtained for a wide range of aircraft designs and operating conditions.

In addition to these routine operational records, several Northrop F-61 Black Widow twin-engine fighters have served as specially-equipped research planes, flying directly through violent thunderstorms in the U.S. Weather Bureau Thunderstorm Project.

Maneuvering loads records are being obtained by both Air Force and Naval Aviation, although these data only indirectly include effects of gust loads.

►Gust Magnitudes—Most recently published data[6] cover only those transport records taken from 1932 to 1942 and do not include information on the more heavily loaded and faster postwar transports.

However, these records are indicative of the general magnitudes of gust velocities which, of course, do not vary with airplane size or geometry. Since they cover 74,028 hr. of landplane operation, and 60,329 hr. for flying boats, it can be expected that they furnish an adequate cross-section of gust characteristics along the routes flown.

These data indicate that the maximum effective gust velocity, based upon airplane design wing loading, normally to be encountered in service is ±40 fps. at all useful operational speed values.

Although at first glance it is indicated that this value is well in excess of the standard design value of 30 fps., two points are to be noted:

- Value of 30 fps. must be multiplied by K which, in the case of more modern transports, brings it to approximately 36.
- The value of ±40 fps. is based upon the airplane design wing loading, which is in excess of the average operating wing loading in the bulk of the records.

It is assumed probable that the wing loading in the bulk of the records was only 85 percent of design which would further reduce this maximum effective gust value more nearly to that used in design.

►Frequency of Occurrence—Having determined maximum normal gust intensity, frequency of occurrence of gust intensities must be determined if a proper evaluation of aircraft life expectancy is to be made. Frequency of occurrence of gusts is dependent largely on the value of the threshold used; that is, the smallest gust velocity which the instrument is capable of recording.

If the instrument only recorded gusts greater than 20 fps. and three of these occurred in 1200 hr. of operation, then it would be assumed that one gust occurred each 400 hr., while if the instru-

ment showed gusts of 1 fps and 1200 of these are recorded in 1200 hr. of flying, then a value of one gust per hour would result.

The NACA V-G recorder used in most of these tests had a threshold of 0.3 fps. and current recorders indicate gusts of much lower velocity.

Rigorous statistical analysis is required for a significant interpretation of the mass of data. For example, only those records taken from aircraft operating under approximately the same conditions of locale, weather, speed and altitude are comparable. "Class intervals" must be selected carefully so that all of the data may be used in plots of frequency vs. velocity. There is a variety of methods used in the analysis of such records and they must be selected with great care else deceptive conclusions be reached.

Fig. 3 gives the results of the study in a plot of relative frequency vs. effective gust velocity. The graph indicates a relative distribution which eliminates several widely divergent records obtained under unusual circumstances; for example, one of the worst gusts ever encountered in prewar trans-Pacific operation. These data show the relative independence of gust frequency from airplane size, since they include data on aircraft varying from an Aeronca C-2, used in a special investigation, to the 35-ton Boeing 314 flying boat.

► **Path Ratio**—The fact that this frequency distribution follows a fixed pattern indicates that the total frequency is proportional to the distance flown within turbulent regions. To determine the frequencies of significant gusts, an average gust interval, λ is used and defined as the average distance along the flight path in turbulent air between significant gusts. Plots of this value vs. airline wing chord showed an approximate linear relation between the two at a value of 11 chord lengths, and this value is used as the average gust interval.

It is obvious that transports fly long distances during which no significant gusts are encountered, followed by entry into turbulent air where significant gusts are encountered with great frequency. Relationship between these two types of flight conditions is termed the path ratio and is defined in this equation: $F = 5280\ R/11c$, in which F is total frequency; R, path ratio, L, length of flight operation, mi., and c, chord length, ft.

Path ratio and, therefore, total gust frequency for any path of operations, will depend on the operating conditions. For example, a feederline transport operating overland at low altitude would encounter a greater percentage of turbulent air than an airplane operating at high altitude above the mechanical

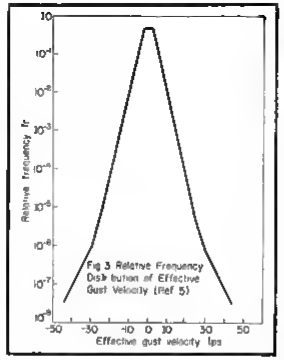


Fig. 3 Relative Frequency Distribution of Effective Gust Velocity (Ref. 5)

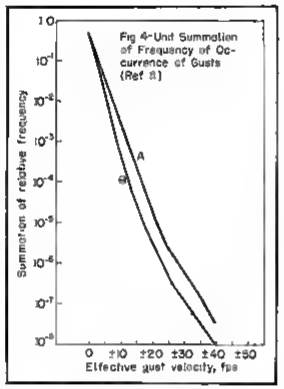


Fig. 4 Unit Summation of Frequency of Occurrence of Gusts (Ref. 8)

turbulence of the ground and above most of the convective clouds. On the basis of available data, an average value of path ratio of 0.1 appears reasonable.

From the foregoing, then, it has been determined that the transport airplane will encounter gusty air about 10 percent of its route air time and that within that gusty air it will strike a significant gust every 11 chord lengths.

► **Stress Frequencies**—It is now pertinent to determine the frequency of occurrence of related loads on the airplane structure. In choosing a gust frequency for design purposes, the choice may lie between a distribution having relatively high frequencies at the higher values of effective gust velocities or one having higher frequencies at the low effective gust velocities.

Fig. 4 indicates the two limiting relative-frequency polygons representing the approximate upper and lower limits of the data used in Fig. 3. This is the basic design chart used in determining values of stress frequency. However, there are several phenomena that must be included in the application of these data to stress analysis.

Analyses of V-G recorders on the basis of simply counting the "peaks" eliminates the possibilities of superposition of small gusts on the larger gusts counted. In determining the number of gusts encountered in a flight, only those peaks which began and ended at the IC datum line were included, since they most accurately indicate a gust.

However, a special count of all peaks, regardless of point of origin, indicated that the number of such superimposed peaks was about twice as high as those occurring individually about the datum line. Most of these peaks occurred near the threshold value of 0.3 fps.

Although these are not of practical significance in a determination of major loads on the structure, they may be of substantial importance in determining its fatigue life.

► **Specific Craft Data**—Distribution of the gust velocity is, of course, not always uniform along the span, and unsymmetrical gusts will occur with a frequency depending upon airplane size and arrangement. Rational unsymmetrical gust load criteria are not yet available, although some work has been done based upon specific airplanes.

Using data obtained from the Boeing XB-15, a semi-rational criterion has been developed. While not applicable to the design of the main aircraft structure, it is of value in the design of engine mounts or similar large masses distributed at a distance from the wing root and, therefore, subject to unsymmetrical gust loads.[7]

This criterion establishes an effective gust velocity at the tips of 20 fps., positive at one tip and negative at the other, with a linear distribution between the two. It states: $Ue' = 0.8\ Ue$, in which Ue is symmetrical effective gust component to be used concurrently with the unsymmetrical component, and Ue, the design symmetrical effective gust.

Data based on results of the XC-35 Gust Research Project, however, indicate that this criterion is conservative, since the XC-35 data show the maximum increment of effective gust velocity obtained in flight for the unsymmetrical gust was ±9 fps.[8] These tests also indicated that the most probable lateral gust shape encountered in flight is triangular, with the other gust shapes, in order of their respective frequencies, being (1) the unsymmetrical and (2) the rectangular combined with the trapezoidal shape in which the effective gust velocity is constant across the span to one tip but drops sharply at the opposite tip.

If the magnitude of the average effective gust velocity for the critical triangular gust is considered to be 30K fps., the average effective gust velocity for the critical unsymmetrical case, based on the same frequency, would be 23K fps. Lateral gust gradient distance was found to be a value of 9 chord lengths.

However, all of these data are of preliminary nature only and considerable work, both theoretical and experimental, remains to be done before a rational criterion, useful for design, is available.

► **Dynamic Response**—A third phenomenon affecting the direct applicability of Fig. 4 is the dynamic response of the structure. Gust loads, for simplicity of calculation, have previously been assumed to be static loads applied to a rigid airplane.

For personal type aircraft, the assumption of a rigid structure appears to be reasonable but the trend towards larger and faster airplanes necessitates the determination of methods for the calculation and evaluation of the effects of dynamic response.

It is in this respect that gust loading takes on the aspects of an aeroelasticity problem.

Several approaches to this problem have been taken, each with simplifying assumptions. Pierce[9] analyses the fundamental mode of bending of the wing under symmetrical loads which are assumed to be known by replacing the airplane with an equivalent biplane and elastic system.

The problem is then resolved into one of obtaining the proper constants to be used as coefficients in simultaneous linear differential equations which represent the equivalent biplane. The method is supported by experimental tests.

It has indicated that the dynamic stress ratio for airplane wings increases as the gradient distance of the gust decreases, an assumption of a 10-chord gradient distance leads to as much as a 12-percent overstress and repeated gusts do not seem to be more critical than a single gust.

In a study of changes of airplane parameters, the method indicates that a change in forward velocity does not appreciably change the dynamic stress ratio, a reduction in wing frequency by a change either in weight or in stiffness of the wing results in an increase in the dynamic stress ratio, wing-tip acceleration increment is generally much greater than the fuselage acceleration increment and the ratio of the two increments tends to increase as the speed increases. Other calculations show that this ratio is about two at a speed of only about 200 mph.[9]

(Continued on page 28)

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▶**Another Study**—A similar study by Sears,[10] which assumes a wing elastic in bending but rigid in torsion, uses a monoplane with springs supplying the elastic properties and two-dimensional flow conditions existing over a typical section.

These results indicate that fortunately the aerodynamic forces damp out the oscillation at high speeds, so that stresses greater than steady-state values do not occur at these speeds.

However, the results are applicable only to the case of a wing infinitely rigid in torsion, and these calculations would have to be extended to include the relative rigidities in bending and torsion of an actual wing.

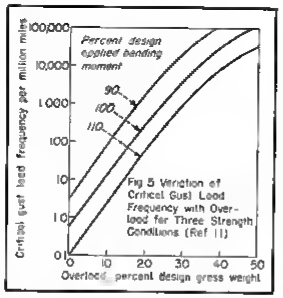
Because the natural period of wings increases almost in direct proportion to the wing dimensions, and because the size of gusts to which the airplane will respond increases as the airplane size, the ratio of natural period to period of application of load remains constant for constant flight speed. Dynamic response of the structure would, therefore, appear not to increase with airplane size.

Probability of structural failure from gust loads increases rapidly with overloading of the airplane.[11] Total applied load for which an airplane structure is designed is composed of a steady load equal to the weight of the airplane plus a load increment due to maneuvers or gusts.

An increase in the steady load reduces the allowable increment due to gusts. Effect of this overload on critical gust frequency is shown in Fig. 5 and indicates the seriousness of such situations.

As a measure of Civil Aeronautics Board concern with the importance of gust load criteria as a major transport design factor, design peak gust velocity has increased steadily over the past few years.

Civil Air Regulation, Part 4a specifies 30 fps. Part 4b specifies 40K fps., and proposed Part 4c further increases this value to 66 fps.



▶**Effect on Fatigue Life**—Effect of gust loads on an airplane structure is of two separate consequences. Designers previously have been concerned principally with the first of these effects—creation of loads which exceed the structural strength of the airplane, resulting in failure.

The solution to this problem has been to determine how strongly and how often such gusts occur and to design according to these data.

The second, perhaps more important, but much more obscure effect of gust loads, is a reduction in the life expectancy of the airplane through fatigue. In this case it is the cumulative effect of the small gusts, rather than the loads applied by a few large gusts, that produce consequences deemed to be sufficiently serious.

For example, it is common practice for pilots to reduce speed when entering turbulent air, to reduce the load factor increment created by the gust. Oddly enough, however, this slowing down has a negligible effect on the fatigue life because only the stresses resulting from the relatively few large gusts and from a small number of the smaller gusts have been diminished.

Fig. 6 presents a typical "S-N" curve, which illustrates the well known condition that the number of cycles required to cause failure decreases as the stress amplitude or maximum stress increases.

The fact that slowing down of the airplane in gusty air has little effect on fatigue life follows from the situation, shown in Fig. 6, that diminishing the infrequent large stresses on the summation curve does not influence the number of cycles of the smaller stresses required to cause contact of the summation and S-N curves.

Another paradoxical relationship between gust loads and fatigue life is that, although higher wing loadings aggravate the structural failure risks of gusts, the net effect of higher wing loadings on the fatigue life is favorable, since the favorable effect of reduction in stress amplitude has more than offset the deleterious effect of the increase in mean stress.

Effect of increasing speeds has only a moderate effect on fatigue life, since increasing speed approximately offsets the favorable effect produced by increasing the wing loading. Hence, if speed and the wing loading are increased concurrently (which usually follows), not much change in fatigue life occurs.

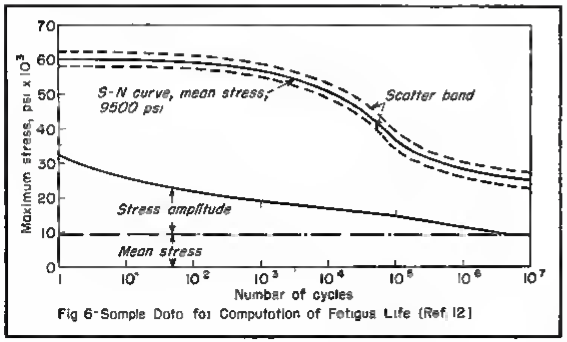


Fig 6 Sample Data for Computation of Fatigue Life (Ref 12)

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Northrop Acquires Electronic "Brain"

First private firm to purchase an all-electronic computer to help solve its engineering problems is Northrop Aircraft, Inc., Hawthorne, Calif.

Called BINAC, the machine was built to order for Northrop by Eckert-Mauchly Corp., Philadelphia, and reportedly is the second of the only two purely electronic "brain" units in existence.

Only similar computer is its much larger 30-ton parent, ENIAC, developed in 1946 for the Army by inventors, J. W. Mauchly and J. P. Eckert, Jr. With dimensions of only 5 × 4 × 1 ft., the new computer fits in an average size office and is tiny in comparison to its predecessor.

BINAC actually consists of twin computers having duplicate arithmetic channels for double checking at every step in the solution of a problem. Also included are two mercury tube units, which are the main reason for BINAC's lightweight. Invented by Eckert, these units make it possible for the computer to get along on 1400 vacuum tubes—instead of the 18,000 required in the ENIAC.

For the past month, Northrop engineers and mathematicians who will operate the machine, have been put through an intensive training course by Eckert-Mauchly. It is estimated the computer staff will consist of several operators and service engineers, one or two mathematicians to program problems, and typists to prepare magnetic instruction tapes.

According to John K. Northrop, president of the aircraft firm, "BINAC will be of extraordinary value in reducing preliminary design and test time on most research and development projects . . . calculations formerly impossible or impractical of solution can be completed rapidly with savings of hundreds of thousands or possibly even millions of dollars in time and money."

Steel Alloy Developed For Low Temperatures

A new alloy steel, reported capable of meeting exacting engineering requirements at temperatures down to —423 F., has been developed by Lebanon Steel Foundry, Lebanon, Pa.

An austenitic cast ferrous alloy, Grade 22, containing, in part, 19½ and 9 percent chromium and nickel respectively, the material already has been used in production of steel castings for pressure equipment in storage facilities for liquid oxygen used in

rocket engines. The oxidizer is contained under high pressures at approximately −298 F.

Impact tests on the new steel reportedly have revealed no structural changes down to −423 F, but have indicated appreciable increase in hardness directly proportional to dropping temperatures.

Tensile strength of the austenitic alloy varies inversely with temperature, and in direct relation with hardness. Ductility is lowered, but not in proportion to increase in tensile strength, estimated to be about 200,000 psi at −423 F. The steel is said to retain adequate strength factors and resistance to embrittlement at this temperature.

Doman Demonstrates Rotor Stability

The Doman helicopter has demonstrated "unusual stability," in test flights lasting almost an hour, without the pilot touching any of the controls, according to reports from the maker.

Despite windy conditions in a recent demonstration flight for the newsreels, Al Bott, test pilot for Doman Helicopters, Inc., Danbury, Conn., ignored the control stick, pitch control and throttle for extensive periods at low altitudes by reading during the trial.

After flying hands off for 45 min. in another flight, the pilot stated he could have continued in this manner until the fuel ran out.

The company attributes the craft's exceptional stability to "several basic yet simple improvements in the blades and in the control system," which eliminate the need for gyro devices.

A two-thirds reduction in parts also has been gained through elimination of complicated hinges and dampers from the four bladed, dynamically balanced rotor.

First Doman production helicopter is slated to be the "Pelican," a 245-hp., utility machine designed to carry 7 passengers, or 1000 lb. of insecticide for agricultural spraying or dusting.

Dural Bars Fitted To Steel Jigs

Maintaining close tolerances in fabrication of aluminum alloy parts always has been a tough problem in the aircraft industry.

This is especially true where aluminum is worked on steel jigs in areas subjected to fairly wide temperature changes. Dural, for instance shrinks or expands at twice the rate of steel in response to identical temperature changes.

If nothing were done to counteract this expansion and contraction, components of the airplane fabricated in steel jigs at different times and temperatures would either gap or overlap when joined together.

While this problem can be overcome by switching from steel to dural jigs, costs and lack of material often prohibit this step.

A way out of this dilemma was found by engineers at Boeing Airplane Co., Seattle, Wash., through use of dural length bars fitted within the steel jig framework.

The length bars are attached to the base of the jig through slots which permit the bars to slide just enough to compensate for the different contraction-expansion rate between steel and dural.

The aluminum alloy panel or other component is worked on the jig in the usual manner. But the dural bars are used to locate the jig members which control the length of the part under fabrication.

Boeing has found however, that this compromise of steel and dural does not suit all situations. It uses all-dural jigs for some purposes, regardless of cost.

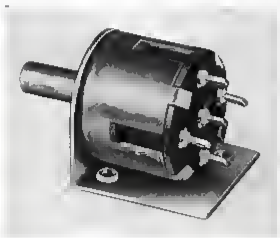
NEW AVIATION PRODUCTS

Voltage Source

For industrial and laboratory instruments requiring accurate, highly stable, d.c. voltage, **Hastings Instrument Co.**, Hampton, Va., offers "Electronic Standard Cell."

Unit is available for any specified output voltage from 0-100 d.c. and for any load up to 30ma. Cell, represented to hold output constant to better than .1 percent, with less than .01 percent ripple, throughout input range of 75-135v. a.c. at frequencies from 50-400 cps, is sufficiently small for use as built-in component for larger instruments.

Company claims unit will operate efficiently over wide temperature range and is not damaged by momentary short circuits. It can be used for reference voltage in bridge or potentiometer circuits or for supplying continuous current for instrument power supply. Precise output voltages such as 10, 1, or 100 d.c., or standard cell voltage of 1.018 can be obtained.



Tab Switch

Small, five-position switch, developed by **Guardian Electric Mfg. Co.**, 1621 W. Walnut St., Chicago 21, Ill., is primarily designed to control trim tabs on jet planes, but can be used in other applications requiring central switch for four separate circuits.

Unit has "off" position in center and four operating locations displaced radially at 90 degree intervals. For use in 3 amp., 28v. d.c. circuits, it weighs approximately .03 lb. Materials are represented to conform to Air Force specifications. Dimensions are 1⅛ × ¾ × ⅞ in., with ¼ in. long shaft having ⅜ in. dia.

Extracts Bearings

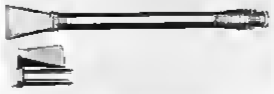
For removing and replacing fans, ball bearings, races and seals on shafts and armatures, **Double B Tool Co.**, 1561 E. 27 St., Cleveland, Ohio, offers lightweight device to replace arbor and assorted step plates. Shaft range with this tool is from less than ¼ in. to over 1¼ in. Unit weighs 4 lb.

Detects Leakage

"Trace" leak detector is offered by **Highside Chemicals Co.**, 10 Colfax Ave., Clifton, N. J., as an efficient means of locating leaks in hydraulic or other types of closed liquid system.

Product is represented to give early warning of leakage by depositing red film at point where leak occurs. Company claims it usually permits detection of leaks which cannot be found by other methods. Material is said to be noncorrosive and to remain active indefinitely.

Product is available in high grade lubricating oil medium for use in systems containing oil or fluids compatible with mineral oil. It also is available in modified forms for systems having aqueous liquids and chemicals of other types. Company claims it already has been successfully used in brake assemblies and aircraft hydraulic controls.



Fire-Fighting Aid

For fighting large-area fires, "Air Foam Playpipe," made by **Pyrene Mfg. Co.**, Newark, N. J., is designed to project either 90 ft. jet of foam or 30 ft.-wide fan-shaped discharge with 75-ft. range.

Hinged tip at end of pipe is folded back for jet discharge or locked over end for wide-area coverage of flames. Nozzle fits 2½ in. hose and can be used as handline by one man at foam pressures up to 100 psi. It also may be used as turret nozzle mounted on truck. Device will pass 1600 gpm. of foam by using 160 gpm. of water at 100 psi. with 8 gal. of low-expansion foam compound.

Paint Sprayer

Self-contained spray gun constructed integrally with compressor and motor sprays quart of paint or other liquid, under 50 psi., in less than 4 min. Offered by **Selco Corp.**, Minneapolis, Minn., device is said to permit easy one-hand operation through pistol grip handle and trigger action. Unit operates on 110v. a.c.

LEASING PLANES to nonscheduled airlines, and performing maintenance on them, has kept California Eastern Airways in business

Coach vs. Cargo As Profit Maker

California Eastern, loser of $900,000 as a freight carrier, pulling out of red in the air coach field.

Money making potentialities of air freight don't approach those of air coach in the opinion of one uncertificated operator that has tried both

The carrier, California Eastern Airways, faced immediate liquidation little more than a year ago after losing $900,000 in the freight business. Now it is slowly whittling away its debts through operations in the cut-rate passenger field.

The striking reversal in CEA's fortunes is explained by company president Andre de Saint-Phalle this way:

▶ **Human Values**—"Airfreight moves at about 15 cents a ton mile and competes principally with first-class rail express which costs about 10 cents a ton mile. The shipper, therefore, pays a premium of about 50 percent for the greater speed of airfreight, which provides second morning delivery from coast to coast, compared with fourth and fifth morning delivery by the fastest surface transportation.

"But at present airfreight rates, an excessively high load factor is required to attain a break-even point. None of the major all-cargo lines has been able to maintain such a high load factor, and, as a result, they have consistently reported operating losses.

"By contrast, since a passenger and his baggage weigh, on the average, 200 lb., the air coach rate of 4 cents a passenger mile is equal to 40 cents a ton mile. The potential revenue per plane mile in air coach is, therefore, 266 percent higher than in air freight.

"It is probable that with the progress of aircraft design, freight will move by air in volume at rates more competitive with surface transportation at some time in the future. Such improved aircraft, however, will also compete even more successfully against surface carriers in passenger transportation."

▶ **Railroad Problem**—"Reason for this is that the cost to the railroads of hauling passengers (representing a weight of one ton) is at least three times greater than the cost of hauling one ton of freight. The coast to coast air coach fare at 4 cents a passenger mile is $99, compared with $76.42 for rail coach and $48.90 for bus.

"Air coach takes 57 hours less time coast-to-coast than rail coach and 81 hours less than bus. Further, the passenger obtains a substantial saving in meal costs."

Saint Phalle recently told the Senate Interstate and Foreign Commerce committee that profitable and unsubsidized transcontinental air coach service at $70 is easily foreseeable with modern equipment.

▶ **Earnings Reported**—By leasing its four DC-4s to large irregular carriers, California Eastern rolled up a $104,769 net profit during the first half of 1949. The Oakland, Calif., company paid off its priority creditors in full, with interest, and has high hopes of remaining in the black.

During the first part of 1948, California Eastern was the third largest independent all-cargo carrier, ranking behind Slick Airways and the Flying Tiger Line in ton miles flown. But in May of last year CEA went into bankruptcy with its application for an airfreight certificate still pending before the Civil Aeronautics Board.

▶ **Cargo to Coach**—The company had the choice of quitting business—with the equity of its stockholders being wiped out—or finding a new source of revenues that would exceed expenses. In June, 1948, CEA decided to convert one of its C-54s to passenger service on an experimental basis. (It now is converting all four of its C-54s to 73-75 seats.)

SAINT PHALLE: Heads you win, cargo you lose

The plane was leased to a nonscheduled air coach operator in July, 1948. Since then, the company has made steady progress back to solvency. Originally it leased planes, crews and facilities to nonscheduled lines, and per-

formed all the maintenance. Then because CAB said that arrangement was a violation of the law, CEA furloughed its pilots and the lines renting the equipment hired them. That made everything legal, CEA says.

A month ago, California Eastern's application for an all-cargo certificate was turned down by CAB. But CEA does not envy Slick, the Flying Tigers and U S. Airlines, which received route awards. In Saint Phalle's opinion, the status of the freight carriers remains uncertain "and their operations are believed to continue unprofitable."

▶**Expansion Considered**—But CEA also is realistic about its own future. It wants to broaden its operations so that besides leasing and maintaining equipment it may engage directly in world-wide tramp operations, in irregular interstate and regular intrastate air coach transportation, and possibly in scheduled domestic coach service if CAB grants its application for a passenger-carrying certificate.

California Eastern believes that in time it would own its four DC-4s free and clear and earn a satisfactory profit on its invested capital if it could assume indefinite continuance of the company's present income from leasing equipment to nonscheduled operators. Fundamentally, it thinks that leasing aircraft to carriers which do not possess sufficient capital to own all the equipment necessary for their requirements can be a sound business.

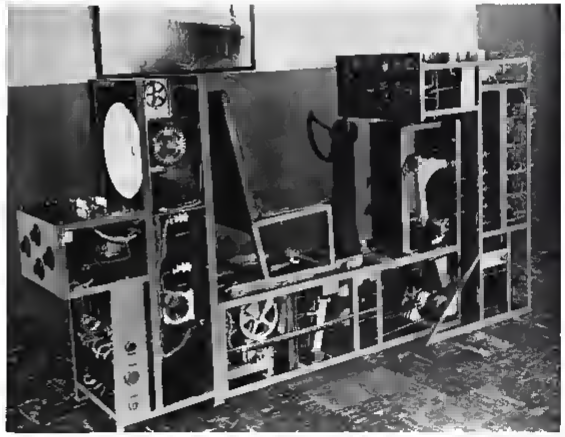
By shifting equipment to different areas having complementary peak demands, CEA could supply the requirements of a number of lines and keep its aircraft busy. Actually, however, the problem isn't that simple. Some of California Eastern's customers may eventually be forced out of business by their inability to comply with CAB's nonscheduled regulations. Others may be able to go out and purchase their own planes.

▶**Certificate Bid**—Consequently, CEA last April filed its application for a transcontinental coach-type certificate. Route requests of other companies are to be heard by CAB at the same time, and no decision in the case is expected before late next year. Meanwhile, California Eastern wants to conduct irregular coach operations on its own hook.

CEA is especially proud of its maintenance setup at Oakland. It claims the ratio of mechanical delays to miles flown with its DC-4s is the lowest of any four-engine operator in the U.S.

The company hopes to secure additional outside maintenance work from the Air Force and from other carriers. At present, CEA has only a small amount of outside maintenance business.

STRATOCRUISER COCKPIT (looking aft) is one version of Dr. Dehmel's simulator



AT-6 MOCKUP is another, showing the wide range of application for the system.

How to Train Crews at a Profit

Dehmel electronic trainer, as used by Pan American, frees aircraft for revenue producing operations.

By Stanley L. Colbert

Dr. Richard C. Dehmel's wonder box—the electronic flight simulator—costs nearly as much as a twin-engine medium transport, and it doesn't carry any payload. But operators are finding the simulator is industry's top-drawer—can produce a profit—in training pilots.

At Pan American Airways, where the simulator is a complete replica of the Stratocruiser cockpit, pilots are putting in 72 percent less time in the actual aircraft. Training flights in a Stratocruiser would cost nearly $1000 per hour with the possibility that a serious mistake on the part of the crew could cause the loss of an aircraft valued at nearly $1.5 million.

▶**Uses**—The simulator does this. At an operating cost of $50 per hour it removes risk to the aircraft and crew, at the same time eliminating the need of taking a revenue producing transport out of service.

Curtiss Wright, manufacturer of the device, estimates it can be used to replace 90 percent of training flights necessary to maintain flight crew proficiency in simulated emergencies as well as normal flight. C W. also says the simulator can reduce by one-third actual transition flight training in specific aircraft.

▶**Economics**—Here's what it adds up to in dollars and cents: Pan American's forecast for minimum pilot training on the actual Stratocruiser is 10.5 hr. per pilot.

Based on $1000 per hour, this would be $10,500. But utilizing the Dehmel simulator, PAA estimates minimum training will be 15 hr. per pilot in the trainer and 4.08 hr. in the air. Taking the figure of $50 per hour for the simulator, and $1000 per hour for actual flight, this would be $4830, or a saving of $5770 per pilot in Stratocruiser training.

While training cost figures vary for different airlines and aircraft, it is apparent that the Dehmel flight simulator—which costs between $200,000 and $250,000—means more training at less cost to the operator. Carriers now wonder what other flight problems can be solved by mechanical simulation of condition.

Pan American Airways, so far the only airline purchaser of a simulator, is helping pay the purchase cost by training Stratocruiser crews for British Overseas Airways Corp. and American Overseas Airlines. But airlines are not the only users of the Dehmel simulator.

Air Force is in the process of using simulators to train service pilots on six types of aircraft, including the B-50. Curtiss Wright has orders for more than 40 trainers, and most of these are for the military. During the war, Dehmel simulators were used to train AT-6 and P-38 pilots. The device is just as effective in simulating jet flight as it is for reciprocal engine flight.

▶**Trouble-Maker**—At the "bug-box" station of PAA's simulator, an instructor can cause havoc by producing more than 40 mechanical malfunctions, including trouble with fuel flow, fuel pressure, fuel quantity, difficulties with oil pressure, carburetor icing, faulty

AIR RESCUE

Over faraway jungles, deserts and mountains, helicopters of the USAF Air Rescue Service have flown in search of stranded airmen and passengers. The helicopters got there because they have been given a "mother" ship—the Fairchild Packet—that transports them over distances far beyond their range. Thus, our Air Force has added a new ability to the versatile Fairchild Packet—increasing the importance of its part in the development of modern airborne military tactics.

Mission of Mercy—Air Rescue personnel load a helicopter into the spacious cargo hold of a Fairchild Packet.

FAIRCHILD ENGINE AND AIRPLANE CORPORATION
HAGERSTOWN, MD.

Divisions: Ranger Aircraft Engines, Farmingdale, N. Y. • Hope Oak Ridge, Tenn. • Fairchild Pilotless Plane, Farmingdale N. Y. • All-Fin, Farmingdale N. Y.
Subsidiaries: Stratos Corporation, Farmingdale N. Y. • Duramold Aircraft Corporation, Hagerstown, Md.

spark plugs in a bank of any engine, circuit breaker overload, landing gear failure, flap failure, wing icing, rudder boost failure and fire in various sections of the aircraft.

Through intricate devices built in the simulator, familiar sounds are accurately reproduced. Advancing the throttles causes the engine to roar. The screech of the tires is heard as the plane makes touchdown.

▶**Life-Like**—Pan American flight instructors claim pilots forget entirely they are in a mockup and react at the controls the same as they would under regular flying conditions. Training covers every conceivable kind of trouble that could develop.

But these troubles would never be tried on actual aircraft because of the heavy risk to personnel and equipment. In the Dehmel, unit crews get an accurate "feel" of the operating characteristics of the aircraft, all of which are faithfully reproduced.

In addition to its three big features—saving time and money in crew training, providing a safe method for simulating possible flight emergencies, and releasing aircraft for revenue-producing trips—the Dehmel trainer has a fourth, as yet untested, advantage. Pan American estimates it will materially reduce flight time requirements for maintaining pilot proficiency.

▶**Checkout Saving**—Currently, PAA semi-annual checks cover two hours instruction and two hours in flight. Based on a checkout of 33 crews per year, both in the original checkout and the semi-annual recheck, Pan American estimates the simulator will save 288.54 hr. time on the aircraft in a 12-month period.

This is equivalent to nearly 23 trips from New York to London, for which Pan American charges a one-way fare of $350 on its 61-passenger Stratocruisers. At 90 percent load factor, a Pan American estimate from reports on summer traffic over this route, actual added income would be $194,150.

Curtiss-Wright's Caldwell, N. J., plant currently employs about 150 persons engaged exclusively in simulator production. Dr. Dehmel told AVIATION WEEK that each unit requires about 10 months to construct, since many of the parts have to be hand-tooled. But the principle of operation for every simulator is the same.

Curtiss-Wright sees more uses for the simulator theory than in training and familiarizing pilots. As a research instrument the simulator may make it possible to study the mechanical and weather-produced "fields of hazard" which up to now could not be explored without risking damage and destruction to the aircraft and personnel.

Indian Overseas Folds

(McGraw-Hill World News)

Bombay—India's third airline collapse of the year is in the making, with the government suspension of Indian Overseas Airline. IOA's Bombay-Nagpur-Calcutta service had been operated on a daily basis, but lack of funds to pay for servicing of its Dakotas had reduced frequency to less than half of schedule. IOA's fleet consists of 15 Dakotas and one Skymaster, the latter bought for an ambitious Bombay-Australia service that never got under way. Latest flight statistics, for March, point up the line's poor position. That month its planes flew 196,000 mi. but carried only 754 passengers and 51,319 lb. of freight.

ATA Sees Upswing

Air Transport Association predicts that the 16 scheduled domestic trunklines will fly 6.5 billion passenger miles this year—nearly 500 million more than in 1947, the previous record year.

The estimate is based on a 15 percent passenger traffic increase in first-half 1949 over the same 1948 period. It takes into account a possible decline in traffic during the second half of 1949 but assumes that passenger business will remain substantially above the last six months of 1948.

Pan American Forms Safety Group

Safety for flight crews is the objective of the Joint Flight Safety Committee, formed by pilots, engineers, radio operators, flight service personnel and management of Pan American Airways' Atlantic division.

Composed of five representatives from each of the safety committees of these groups, the organization intends to conduct research on subjects which will augment safety procedures, equipment and policy for Atlantic flying.

First project of the committee is an attempt to clarify firefighting procedures. Undertaken with full management sanction, the group hopes to define and test action which should be taken in case of fire in various sections of the aircraft.

The committee is active only in the Atlantic division of Pan American. But the organization hopes that other divisions of the carrier, and other carriers, will form similar organizations.

Chairman of the Joint Flight Safety Committee is Peter De Riemer, PAA instructor in emergency procedures. The committee was formed early in July and meets the last Monday of each month in closed session at LaGuardia Field in company furnished space.

Cut Red Tape

Ways to cut travel red tape have been discussed by Pan American Airways' System Facilitation Committee, composed of representatives of the carrier's major divisions and larger affiliates.

Huxley H. Galbraith, chairman of the committee, cited such countries as Argentina, which requires 23 copies of one form listing the complete names of all passengers. "An airline is subject to a $10 fine each time an initial is used," Galbraith reported.

Five simplified documents covering international flights have been recommended by International Civil Aviation Organization and adopted by 17 of the 21 American republics, according to Galbraith, but there are still a few holdouts.

As a tangible move to cut red tape, Brazil has ruled no visas are necessary for travelers planning to visit en route to another country, provided their stay does not exceed eight days. Regulation applies to commercial and pleasure visitors from the western hemisphere and European countries.

Hildred Reports On IATA Traffic

Financial problems of the world's airlines will tend to disappear once the carriers tap the mass transportation market, according to Sir William Hildred, director general of the International Air Transport Assn.

Speaking at IATA's 30th anniversary meeting at The Hague, Holland, Hildred said that for the moment the mass market remains tantalizingly just out of reach.

This, he explained, is because of the carriers' inability to keep on reducing fares in a period when costs continued to rise.

▶ **Mouth-Watering Market**—The IATA leader described the United States as a particularly rich potential reservoir of mass foreign travel with its 20 million families in the $3000 to $6000 a year income bracket. "There is no reason why the amount of U. S. dollars put into international circulation through foreign travel could not be increased from the present level of $800 million a year to $2 billion. It is a market that ought to make all your mouths water," Hildred told 200 top officials of 70 IATA member airlines.

During 1948, IATA members flew 12 billion passenger miles, 100 million ton miles of cargo and 250 million ton miles of mail, Hildred declared in his annual report. The figures represent a substantial increase over 1947, with the most impressive gain registered in cargo.

▶ **Subsidies Needed**—But the IATA director general cautioned that with still rising costs, international carriers must continue to rely on government subsidies to fly at all. "We could no doubt tap the mass market overnight if we made dramatic fare reductions, but already some government agencies (as the U. S. Civil Aeronautics Board) have indicated we ought not go farther in cutting rates at the present time."

Hildred's report urged more flexibility in rate recommendations of the IATA traffic conferences to promote off season and off-peak travel and to take advantage of special events. It asked utmost airline support for efforts to reduce and simplify red tape in customs, immigration and other border formalities.

Other recommendations were: greater attention by the carriers and their governments to problems presented by new jet aircraft; a concerted effort to close the gap between the growing volume of international air transport and the development of airports, landing and navigation aids; multilateral agreement on air transport rights between nations, instead of the present limited system of bilateral pacts, and a delegation of

greater responsibility for actual operations by governments to the airlines themselves.

Tests Show Value Of Dramamine

Virtual elimination of airsickness as a factor in customer resistance to airline travel may be in sight.

Key to this happy prospect is the new drug Dramamine. The Air Force reports Dramamine "is a very effective preventative of airsickness," and tests by Capital Airlines bear out USAF findings.

Dr. L. G. Laderer, Capital's medical director and president of the Airline Medical Directors Assn., recently announced the results of a two-and-one-half year survey made aboard Capital planes.

▶**Quick Relief**—The study showed that only 0.89 percent of 1,120,977 apparently well passengers who were observed suffered discomfort due to motion sickness. When Dramamine was used, the one passenger in a hundred affected by motion sickness was immediately relieved of all discomfort in 75 percent of the cases.

Used as a preventative (before take-off), Dramamine practically eliminated motion sickness—being effective in 90 percent of the cases. Previous experiments with other remedies disclosed that most of these were not effective once symptoms of airsickness were felt by the passenger.

▶**Little After-Effect**—Although Dramamine is a central nervous system depressant, the Air Force found that only 18 of 216 servicemen given the drug during tests suffered any "significant" side effects such as extreme drowsiness, mental depression or dizziness.

Capital's survey showed that of the less than one in a hundred persons affected by motion sickness, 60 percent were women, 23 percent men and 17 percent children. The higher sickness rate among women was attributed "to a lack of tolerance to motion because of sedentary habits."

'Flag Stops'

Two feederlines have been given permission to provide money-saving "flag-stop" service to intermediate points requiring no traffic stop on a particular flight.

After mulling the matter over for more than eight months, the Civil Aeronautics Board authorized the change in service pattern for Empire Air Lines and Wisconsin Central Airlines. Similar flag-stop privileges were given Southwest Airways last June.

The feederlines' certificates had provided that all flights must stop at each point named between the point of origin and the destination. Now the carriers will merely be required to maintain a flight path passing over each of the intermediate points so as to be in a position to land if traffic is available at the scheduled time of the flight's departure from the point.

CAB said the requirement that the carriers make a physical landing at intermediate points even though no traffic is available "results in unnecessary expense, increased flight hazards and annoyance to passengers."

Transport Sales Prospects Brighten

Upturn in airline profits this year is giving a lift to commercial transport sales prospects.

Douglas Aircraft Co. believes its outlook in the commercial field is "the best in two years." Lockheed Aircraft Corp. is quickening Constellation production during the remainder of 1949 and has enough orders to keep the line moving into 1951.

▶**Orders Listed**—United Air Lines' recent purchase of five planes costing $4,329,000 is the biggest firm DC-6 order on Douglas' books. Delta Air Lines, Philippine Air Lines and Panagra have single orders to be filled. Negotiations for the sale of nine more DC-6s reportedly are underway.

Douglas has high hopes of finding commercial customers for its DC-6A cargoplane, prototype of which is slated to fly in October. The company's Super DC-3 sales campaign is being sparked by a 10,000-mile demonstration tour by the new craft.

▶**TWA Deal**—Lockheed's largest piece of commercial transport business is TWA's order for 20 Model 749 Constellations. The $20 million deal was completed last spring, but TWA has just announced that seven banks in five cities have formed a syndicate to underwrite the purchase. Deliveries start next spring.

Commercial orders were only 7.4 percent of Lockheed's $195,901,000 backlog at the end of 1948, but were 20.5 percent of the company's $202,268,000 backlog on June 30, 1949.

▶**Convair Plans**—Meanwhile, Consolidated Vultee is continuing to push plans for leasing Convair Liners to cash-short airlines through its affiliate Airfleets, Inc. The latter company was organized a year ago as Convair Equipment Corp., but no leasing deals have yet been announced.

Ultimately, Consolidated Vultee plans to separate Airfleets from its parent company and operate it independently. This would be done so that Airfleets will be in a "free position" with respect to the airlines leasing equipment (including planes other than Convairs) which Airfleets purchases.

Consolidated Vultee currently is studying the requirements of capital structures which would make the Airfleets separation possible.

Two Profit, Two Lose in Canada

Canada's air transport industry continued to operate in the red last year, although traffic hit a new peak.

Figures released by the Dominion Bureau of Statistics show that four scheduled Canadian carriers had a net operating deficit of $911,000 in 1948, compared with a loss of $2,138,000 in 1947. Total revenue last year was $28,005,000, against $22,300,000 in 1947.

Government-owned Trans-Canada Air Lines, largest of the scheduled carriers, reported $20,866,000 revenue and a $769,000 operating deficit in 1948, compared with $15,297,000 revenue and a $1,561,000 deficit in 1947.

Canadian Pacific Air Lines had $6,141,000 revenue and a $196,000 deficit last year, against $6,207,000 revenue and a $640,000 loss in 1947.

▶**Small Lines Profit**—Two small Canadian carriers, which had combined revenues of less than $1 million were in the black during 1948. Maritime Cen-

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tral Airways, Charlottetown, Prince Edward Island, earned about $50,000 and Central Northern Airways, Winnipeg, Manitoba, earned $4,384.

The four scheduled lines carried a record 716,000 revenue passengers in 1948 on domestic and international routes, a 23 percent gain over the 582,000 reported in 1947. Average passenger load factor was 65.1 percent, against 60.9 percent in 1947. Cargo and mail volume also was up sharply.

Total personnel of the four scheduled airlines numbered 5092 at the end of 1948, against 4794 the year before. TCA reported the most employes last year—3974. Canadian Pacific had 993.

SHORTLINES

▶ **American**—Plans to inaugurate its recently approved southern transcontinental equipment interchange service with Delta Air Lines on Sept. 25. The two carriers' DC-6s will make three roundtrips daily, one between Miami and Los Angeles, one between Atlanta and San Francisco, and one between Atlanta and Los Angeles.

▶ **BOAC**—Passenger and freight sales in North America for the four months ended July 31 were the largest in the history of the carrier's Western Division, totaling almost $3 million.

▶ **Colonial**—Has filed a complaint with CAB charging Resort Airlines is operating illegally between New York City and upstate vacation areas such as Saranac Lake, Lake Placid and Saratoga. Colonial said RAL has carried interstate traffic, failed to file tariffs and published misleading advertisements. CAB was asked to suspend Resort's operations immediately to eliminate the "unfair competition."

▶ **Central Airlines**—The Fort Worth feederline planned to start service with single-engine Beech Bonanzas late last week.

▶ **Eastern**—Has adopted the first-of-the-week family fare plan.

▶ **Inter-American Airways**—CAB has ordered the Miami Springs, Fla., carrier to show cause why its letter of registration as a large irregular operator should not be revoked for knowing and wilful violations of the Civil Aeronautics Act. CAB claims the company has continued to operate with excessive frequency and regularity between New York, Miami and Puerto Rico despite a cease and desist order issued last November.

▶ **New York Airways**—Has asked CAB for a certificate to carry persons, property and mail with rotary wing aircraft over circular and shuttle routes in the New York metropolitan area. Company president is John L. Senior, Jr.

▶ **Northwest**—Had the heaviest domestic traffic in its 23-year history on Sept. 2, when it carried 3357 passengers and took in $100,000 in revenue. Previous record was 3165 passengers last July 1. NWA's Chicago-Twin Cities passenger business increased 47 percent in August, when Stratocruisers were first placed on the run.

▶ **Trans-Asiatic Airlines**—Has asked CAB for a foreign air carrier permit to operate from Bangkok, Thailand, its home base, to Los Angeles and San Francisco via Hong Kong, Manila, the Philippines and Hawaii. Company is 61 percent owned by citizens of Thailand and 38.8 percent by citizens of the Philippines. It has Thailand government approval for the new service, according to D. Sherman Starr, vice president and international general manager.

▶ **TWA**—Domestic traffic over the Labor Day weekend was up 12 percent over the same period last year. . . . Dayton, O., wants TWA to move its headquarters there if the carrier can't renew its lease with the Air Force for facilities at Fairfax Airport, Kansas City. The Fairfax lease expires Oct. 31, 1950, and the Air Force said it might need the space for an expanded program.

▶ **Wiggins Airways**—The Norwood, Mass., feederline expected to start service between Boston and Albany late last week with twin-engine Cessna UC-78s. It has told CAB that mail pay need for the first year (including 7 percent profit and amortization of pre-operating expenses) would be around 55 cents a plane mile.

CAB SCHEDULE

Sept. 12—Hearing on service to Springfield, Mass., through Bradley Field. (Docket 3748)

Sept. 19—Oral argument on Eastern Air Lines overseas mail rate. (Docket 3728)

Sept. 19—Hearing on applications of American and Colonial Airlines for service to Toronto. (Docket 2852 et al)

Sept. 20—Prehearing conference on renewal of West Coast Airlines feeder certificate and temporary suspension of United Air Lines service at Salem, Ore., and Bellingham, Wash. (Docket 3986)

Sept. 21—Hearing in air freight tariff agreement case. (Docket 2710 et al)

Sept. 22—Oral argument on Mid-Continent Airlines application for alternate Kansas City-New Orleans route. (Docket 1888)

Sept. 26—Hearing on Seaboard & Western and Transocean Air Lines applications for all-cargo certificates between the U. S., Europe and the Middle East. (Docket 3461 et al)

Sept. 26—Hearing on proposed Monarch-Arizona Airways merger. (Docket 3977)

Sept. 28—Hearing on disposal of Parks Air Lines routes. (Docket 3565 et al)

Oct. 3—Hearing on Hughes Tool Co. control of TWA. (Docket 2756)

Oct. 10—Hearing on CAB investigation of International Air Transport Association agency resolutions. (Docket 3858)

Nov. 14—Hearing on final mail rate for Florida Airways. (Docket 3895)

Nov. 14—Hearing in Western-Inland mail rate case. (Docket 2878)

Jan. 9—Hearing in air freight rate case. (Docket 1705 et al)

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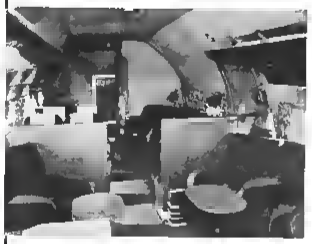

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STRICTLY PERSONAL

CRIES OF ANGUISH APPRECIATED—Thanks to all those who protested this column's frequent non appearance. The most effective expression—we thought—was a curt telegram from **Bob Demme**, American Airlines' assistant publicity director: "Where is Strictly Personal. Cancel my subscription." We sent this document up to one of McGraw-Hill's executives with a modest reference to AW's readership. But these people are pretty hard-boiled here. **Ralph Smith** just sent it back with a quaint note about our stooges in the industry. But when we send up a choice statistic about how the latest Audit Bureau of Circulation report shows that despite our $6 a year rate we now have the largest circulation of any industrial aviation magazine, they'll believe that.

* * *

FINDER OF LOST PERSONS—This colyum has also proved it can find lost persons. From far and wide came reports on the whereabouts of **Jim** and **Mac Haship**. They live at Skyline Farm, Topanga, Calif. Jim sells Bonanzas for **Norm Larsen** at Pacific Aircraft Sales, Burbank. **Max Karant, Bill Melton, Jr., Reader Zimmerman** at Shell Oil and **Allen H. Rhodes** were among our reporting detectives. Two of our readers asked: "And now, where can we locate **Louise Thaden?**" Louise, it was, who asked about the Hasships. She lives at 601 Camilla Ave., Roanoke, Va. We also had a letter from Jim Raship himself, who subscribed to AVIATION WEEK! Said he'd been hearing from everyone that he was lost.

* * *

THE EDITOR'S MAIL—Abby Wolf denies our recent assertion that he is a "Philadelphia insurance mogul." Instead: 'Your faithful contributor hatched his twin eagles—legal and aeronautical—virtually simultaneously over 20 years ago, and he's been flying in the face of the law ever since."

Alex McSurely, associate editor of Av Wk., sends us an ad from a Washington paper for National Flight System. The airplane picture is upside down, "with student and instructor flat on their backs at 30 ft.," Alex points out.

Pan Am has the audacity to send us a press release about "ten little unchilly travelers from Chile, bundled in the world's most expensive fur coats." They arrived in Miami by guess-which airline. The audacity is in their headlines: "Ten Chinchillas Fly a Fur Piece."

* * *

LULLABY, 1949 VERSION—**Capt. Al Eager**, addressing his letter to "Exceedingly Personal," AVIATION WEEK, writes from Nashville that his nightly lament to his infant can now be published exclusively in this colyum:

"Rock-a-bye baby, 500 on top. When the wind blows the airplane will rock. If it should stall, the airplane will fall. And down will come baby, airplane and all."

You get variety here, anyhow!

* * *

WHO'S TEETHING WHOM?—McGraw-Hill Correspondent **Ted Palmer** in San Fran says a newly discharged soldier wanted to buy a ticket at the United Air Lines counter at the S. F. airport recently and pay for it by personal check. UAL's **Bob King** refused because the discharge papers were the passenger's only identification. Suddenly inspired, the ex-C. I. whipped out his false teeth, showed King the serial number—same as the one on his papers—and got his ticket. "Obviously," wrote a local columnist, "here was a man who wasn't lying in his teeth."

* * *

WHOSE SIDE IS HE ON?—**Bill Greenlee** writes that out at Moses Lake AF Base not long ago **Capt. Bill Coburn**, National Guard pilot, shot himself down during ground strafing maneuvers. A bullet he fired bounced back, hit the plane's cooling system, and forced him to land on an emergency strip.

* * *

WELL, MAYBE THEY NEED THE PUBLICITY—We have our doots about this but **Fuzzy Furlong**, Metropolitan Aviation Corp. vice president, phoned us and swears that his staff is reading **Dick Tracy** every day now to keep up with their public. On one critical comic strip day several New Yorkers phoned the heliport to ask if Metropolitan couldn't take one of their copters and get **Pineapple** off the roof. Later, a caller got excited because Fuzzy wasn't doing anything about removing Pineapple from an open cage at the zoo.

—R. H. W.

WHAT'S NEW

New Books

"Theory of Wing Sections," by Ira H. Abbott and Albert E. von Doenhoff, a new volume in the Publications in Aeronautical Science series by McGraw-Hill Book Co., 330 W. 42 St., New York, is scheduled for release later this year. It should prove a valuable reference source for engineers and also serve as a supplementary text for students.

This work, largely the result of research conducted by the National Advisory Committee for Aeronautics, is concerned with the most important results of studies on aerodynamics of wing sections at subcritical speeds. Theoretical and experimental findings included are those deemed by the authors to be the most useful.

Coverage of data is arranged under these classifications:

- Significance of wing-section characteristics.
  - Simple two-dimensional flows.
  - Theory of wing section of finite thickness.
  - Theory of thin wing sections.
  - Effects of viscosity.
  - Families of wing sections.
  - Experimental characteristics of wing sections.
- High-lift devices.
  - Effects of compressibility at subsonic speeds.

Consideration has been given to the needs of those with a limited background in theoretical aerodynamics and mathematics.

"Titanium, Its Occurrence, Chemistry, and Technology," by Jelks Barksdale, Ph. D., Alabama Polytechnic Institute, is a comprehensive working reference volume on the metal whose ever-increasing possibilities are attracting wider interest. The author was formerly research chemist, titanium division of National Lead Co. A very detailed index and reference section is included. Published by The Ronald Press Co., 15 E. 26 St., New York 10 N. Y., 591 pp., Price $10.

Trade Literature

Catalog by Reynolds describes new extensive line of aluminum roll-formed shapes, produced on order from stock dies. Send request to Reynolds Metal Co., Industrial Parts Division, 2000 South Ninth St., Louisville 1, Ky. Ask for Catalog 44-01.

Catalog describing Walker-Turner line of metal and woodworking machine tools, including four new models. Write Walker-Turner division, Kearney & Trecker Corp., Plainfield, N. J.

ADVERTISERS INDEX

AVIATION WEEK

SEPTEMBER 19, 1949

PROFESSIONAL SERVICES—
First issue of each month

■

SEARCHLIGHT SECTION
(Classified Advertising)

EDITORIAL

CAB's Air Coach Decision—An Analysis

Airline proponents of skycoach and other types of cut-rate promotional fares have won a significant victory amoog Civil Aeronautics Board policy-makers

This month, for the first time, CAB conceded that four cents-a-mile tariffs offered under certain restrictive conditions can produce sufficient new traffic to make coach service profitable on certificated routes As a result, it sanctioned the continuance through next June of non-luxury, tourist type operations conducted with high-capacity equipment during off-peak traffic periods (AVIATION WEEK, Sept 12)

But the victory for skycoach was by no means a complete one. CAB also decided that four-cents-a mile service with low-capacity equipment such as 21- or 24 passenger DC-3s probably cannot be conducted at a profit unless almost unattainable load factors (upwards of 85 percent) are maintained over an extended period

"There is little indication," the Board asserted, "that the airline industry is in a position to enter the air coach business on a broad and indiscriminate basis Despite the favorable trend of airline costs and the recent upturn in earnings, the present economic position of the certificated carriers appears to demand continuation of existing fare levels for the great bulk of passenger air travel."

Successful and economic skycoach operations apparently require these conditions, according to CAB

Heavy traffic flow must characterize routes

High-density equipment (with more than the average number of seats) must be used

Service must be scheduled to minimize diversion of traffic from regular flights.

All non-essential services to the passenger, such as in-flight meals, extra stewardesses, full reservations procedures, etc, must be eliminated.

The Board decided that the DC-3 coach operations of TWA between Kansas City and Los Angeles and Continental Air Lines' four-cents-a-mile DC-3 run between Kansas City and Denver did not meet the standards specified As a result, Continental's tariff will not be extended beyond Sept 30 TWA was permitted to continue its DC-3 coach service between Kansas City and Los Angeles through Dec 31 to give the company time to explore the possibility of using high density four-engine equipment in the operation

But the coach services CAB will permit to continue to June 30, together with the new operations it will approve, overshadow termination of the TWA and Continental flights.

Capital Airlines, first certificated domestic carrier to offer tourist-type service, will continue to make its "Nighthawk" flights from Washington and New York to Chicago and Minneapolis/St. Paul with 59 passenger DC-4s. TWA's New York-Chicago coach flights with 38-passenger Boeing Stratoliners and Northwest Airlines' New York Seattle coach run with 55-passenger DC-4s were also approved for a nine-month extension

In addition, CAB said it was prepared to permit Western Air Lines to operate a new 60-passenger DC-4 coach service between San Diego and Seattle if departure times are limited to between 10 pm and 1 am. Suspension of Northwest Airlines' proposed Chicago-Portland, Ore., low-fare flights with 55 seat combination passenger/cargo DC-4s will be lifted.

The Board rejected Capital Airlines' request to extend Nighthawk flights to the New York-Atlanta-New Orleans run with 50 passenger DC-4s and National Airlines' proposed New York-Miami coach service with 46-passenger DC-4s Capital immediately prepared to refile its tariffs to provide for use of high-density 59-passenger DC-4s on the proposed southward extension of Nighthawk service

Capital Airlines officials told AVIATION WEEK they were pleased by CAB's policy statement on skycoach. They noted that the principles for successful coach-type operations set down by CAB are almost identical with those adopted by Capital when it began Nighthawk flights last November The nine-month extension of coach tariffs, Capital pointed out, is by far the longest authorization of this type to be made by CAB.

Coach tariffs filed in the future will be given careful consideration by CAB if they meet the four conditions outlined But the federal agency emphasized that it expects each coach tariff filed to be accompanied and supported by detailed economic justification both from a traffic and cost standpoint.

"The burden of proof for establishment of new coach services is clearly on the carriers," CAB said. "We do not propose to allow the indiscriminate extension of coach fares, nor do we intend to permit a general debasement of the existing passenger fare level."

Turning to other promotional tariffs, the Board declared that the first-of-the-week family fare plan (providing 50 percent reductions on Mondays, Tuesdays and Wednesdays) appears to have been successful in building up traffic during periods when business is normally light. It noted, however, that the degree to which the plan generates new business—as opposed to diverting traffic from a peak to an off-peak period of the week—is not entirely clear

Although complete data for the summer season are not yet available, CAB decided the family fare has generated enough new traffic to warrant continuance of the plan through next June. The Board said it was not ready to approve Continental Air Lines' proposal for a family plan which would be applicable to every day of the week.

Western Air Lines and Inland Air Lines will be permitted to continue their "no-meal tariff" for another nine months Adopted by the two carriers last February, this innovation provided for a 5 percent fare cut in lieu of in-flight meal service.

CAB said Western's contentions regarding economies resulting from elimination of meals appear to have been borne out The Board noted, however, that the effect of the no-meal tariff on Western-Inland business is still uncertain.

Since CAB regards the whole promotional fare structure as an experiment, it will require each carrier with such tariffs to submit a monthly statistical record of results In this way CAB hopes to have a firm basis for determining which promotional fares should become a permanent part of the domestic passenger fare structure